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Calculations from Compliance Emissions of Long- and Short-Term SO2 Concentrations in the Southwest Pennsylvania Air Quality Control Region

H. E. Cramer Co., Inc.
Salt Lake City, UT

Prepared for

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This report describes the results of dispersion-model calculations of maximum annual, 24-hour and 3-hour average ground-level SO_2 concentrations for selected areas in the Southwest Pennsylvania Air Quality Control Region (AQCR). The primary purpose of the model calculations was to assist EPA Region III and the Pennsylvania Department of Environmental Resources in determining the attainment or non-attainment of the National Ambient Air Quality Standards (NAAQS) for SO_2 in the Beaver Valley and Monongahela Valley Air Basins exclusive of Allegheny County. All of the dispersion-model calculations were made using the LONGZ and SHORTZ dispersion models with 1980 compliance emissions inventories containing 492 major SO_2 sources located within the Southwest Pennsylvania AQCR and in Ohio and West Virginia near the western border of the AQCR. The only calculated maximum that exceeds the NAAQS for SO_2 is the maximum annual average concentration at an isolated grid point located on high terrain about 1 kilometer north of the Monessen Plant of Wheeling-Pittsburgh Steel. The model calculations also indicate contributions of major SO_2 sources located along the Ohio River in Ohio and West Virginia to the air quality in the Southwest Pennsylvania AQCR.

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Prepared for:

U. S. Environmental Protection Agency

Under

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Task Order No. 2

H. E. Cramer company, inc.
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ACKNOWLEDGEMENTS

We are especially indebted to Mr. Brian McClean and Mr. Alan J. Cimorelli, our EPA Region III Project Officers, for their technical assistance and guidance during this study. The emissions inventories and most of the air quality data used in the study were principally supplied by Mr. Wick Havens and Mr. Kenneth Bowman of the Pennsylvania Department of Environmental Resources and by Mr. William Muer and Dr. Roger Westman of the Allegheny County Bureau of Air Pollution Control. We also received valuable assistance from the Southwest Pennsylvania Planning Commission, from Mr. James Smallwood of the West Virginia Air Pollution Control Commission and from the Ohio Environmental Protection Agency.

EXECUTIVE SUMMARY

This report describes the results of dispersion-model calculations of maximum annual, 24-hour and 3-hour average ground-level SO_2 concentrations for selected areas in the Southwest Pennsylvania Air Quality Control Region (AQCR). The primary purpose of these calculations was to assist EPA Region III and the Pennsylvania Department of Environmental Resources in determining the attainment or non-attainment of the National Ambient Air Quality Standards (NAAQS) for SO_2 in the Beaver Valley and Monongahela Valley Air Basins outside of Allegheny County. Allegheny County was excluded from the dispersion-model calculations in this report because similar calculations were made in a study performed by TRC, Inc. for the Allegheny County Bureau of Air Pollution Control. However, because the SO_2 sources in Allegheny County affect the SO_2 concentration in the Beaver Valley and Monongahela Valley Air Basins, the major SO_2 sources in Allegheny County were included in the emissions inventories and dispersion-model calculations contained in this report. All of the dispersion-model calculations were made using the LONGZ and SHORTZ computer programs containing the long-term and short-term dispersion models described in Appendix A. In the annual average SO_2 concentration calculations for determining attainment or non-attainment of the NAAQS, the annual 1980 compliance emissions inventory in Appendix C.1 was used with the meteorological inputs given in Appendix B.1 which are based on the 1965 hourly surface weather observations made at the Greater Pittsburgh Airport and Greater Pittsburgh Airport mixing depth statistics for 1960 through 1964. The 1965 Greater Pittsburgh Airport data were selected as typical of a worst-case year in which the meteorological conditions were conducive to high ground-level SO_2 concentrations in the Southwest Pennsylvania AQCR. In the short-term concentration calculations for determing attainment or non-attainment of the NAAQS, the short-term 1980 compliance emissions inventory in Appendix C.2 was used with the hourly surface weather observations and twice-daily rawinsonde observations made at the Greater Pittsburgh Airport on 28 August 1976. This day was selected as the worst-case 24-hour period for high calculated SO_2 concentrations in the Southwest Pennsylvania AQCR on the basis of a detailed analysis of five years (1973 through 1977) of meteorological observations from the Greater Pittsburgh Airport. Specifically, the hourly wind observations for these five years were analyzed to isolate those cases in which wind directions from the southwest quadrant persisted for more than 12 hours with mean wind speeds greater than 2 meters per second. Previous dispersion-model calculations showed that these persistent wind conditions produced the highest 24-hour SO_2 concentrations in the Southwest Pennsylvania AQCR. Of the 20 cases found in the persistence analysis which satisfied the above criteria, the 28 August 1976 case resulted in the highest calculated 24-hour average SO_2 concentrations in the Southwest Pennsylvania AQCR.

The annual and short-term 1980 compliance emissions inventories in Appendix C.1 and Appendix C.2 contain 429 individual sources located within the Southwest Pennsylvania AQCR and along the Ohio River Valley near the western border of the Southwest Pennsylvania AQCR in eastern Ohio and West Virginia. The 1980 compliance emissions inventories used in the dispersion-model calculations were obtained from the following agencies:

- Allegheny County Bureau of Air Pollution Control - Sources in Allegheny County
- Pennsylvania Department of Environmental Resources - Sources in the Beaver and Monongehela River Air Basins and in other areas of Pennsylvania
- EPA Region III, the Ohio Environmental Protection Agency, and the West Virginia Air Pollution Control Commission - Sources in Ohio and West Virginia

The SO_2 emissions and other source parameters supplied by the above agencies were carefully evaluated by the H. E. Cramer Company for accuracy and completeness and were also reviewed and updated by the Pennsylvania DER and EPA Region III.

The results of the long-term and short-term dispersion-model calculations made using the 1980 compliance emissions inventories are presented in Table I which lists the maximum annual, 24-hour and 3-hour average SO_2 ground-level concentrations calculated for the New Castle, Beaver and Monessen grids. These grids, which are described in Section 5.1 and shown in Figure I, were selected as the areas within the Beaver Valley and Monongahela Valley Air Basins with the highest SO_2 ground-level concentrations on the basis of dispersion-model calculations made using the LONGZ computer program with the annual 1980 compliance emissions inventory and the gross calculation grid shown by the dashed lines in Figure I. The major SO_2 sources and SO_2 monitor sites shown in Figure I are identified in Tables II and III. The only calculated maximum which exceeds the NAAQS for SO_2 is the maximum annual average concentration for the Monessen grid which occurs at an isolated grid point located on high terrain about 1 kilometer north of the Monessen Plant of Wheeling-Pittsburgh Steel. The calculated concentrations at adjacent grid points, which are at a distance of 1 kilometer, range from 40 to 61.5 micrograms per cubic meter. The area in which the calculated annual average concentrations are above the NAAQS is therefore less than 0.25 square kilometers in extent. Emissions from the Monessen Plant of Wheeling-Pittsburgh Steel are responsible for approximately 58 percent of the maximum annual average concentration calculated for the Monessen grid.

An important feature of both the long-term and short-term model calculations for the New Castle and Beaver grids is the relatively large contributions from major SO_2 sources located along the Ohio River in eastern Ohio and West Virginia. For example, the combined emissions from all eastern Ohio and West Virginia sources account for 39 percent and 35 percent of the maximum annual average concentrations calculated for the New Castle and Beaver grids, respectively. According to the short-term model calculations, the combined emissions from all of the eastern Ohio and West Virginia sources account for about 60 percent of the maximum 24-hour and 3-hour average concentrations calculated for each of these grids. The air quality impact of the major SO_2 sources in

TABLE I

MAXIMUM ANNUAL, 24-HOUR AND 3-HOUR AVERAGE SO_2 CONCENTRATIONS CALCULATED USING THE 1980 COMPLIANCE EMISSIONS INVENTORIES

Calculation Grid	Maximum Concentration ($\mu g/m^3$)	UTM Coordinates of Maximum (km)	
		X	Y
Annual Average Concentration			
New Castle	37.3	558.0	4,525.0
Beaver	76.8	554.0	4,503.0
Monessen	86.2*	594.0	4,447.0
24-Hour Average Concentration			
New Castle	115.8	555.0	4,533.6
Beaver	251.6	554.0	4,503.0
Monessen	226.9	594.5	4,447.0
3-Hour Average Concentration			
New Castle	337.4	555.0	4,533.6
Beaver	835.5	554.0	4,503.0
Monessen	703.9	594.5	4,447.0

*Calculated maximum occurs at isolated grid point on elevated terrain.

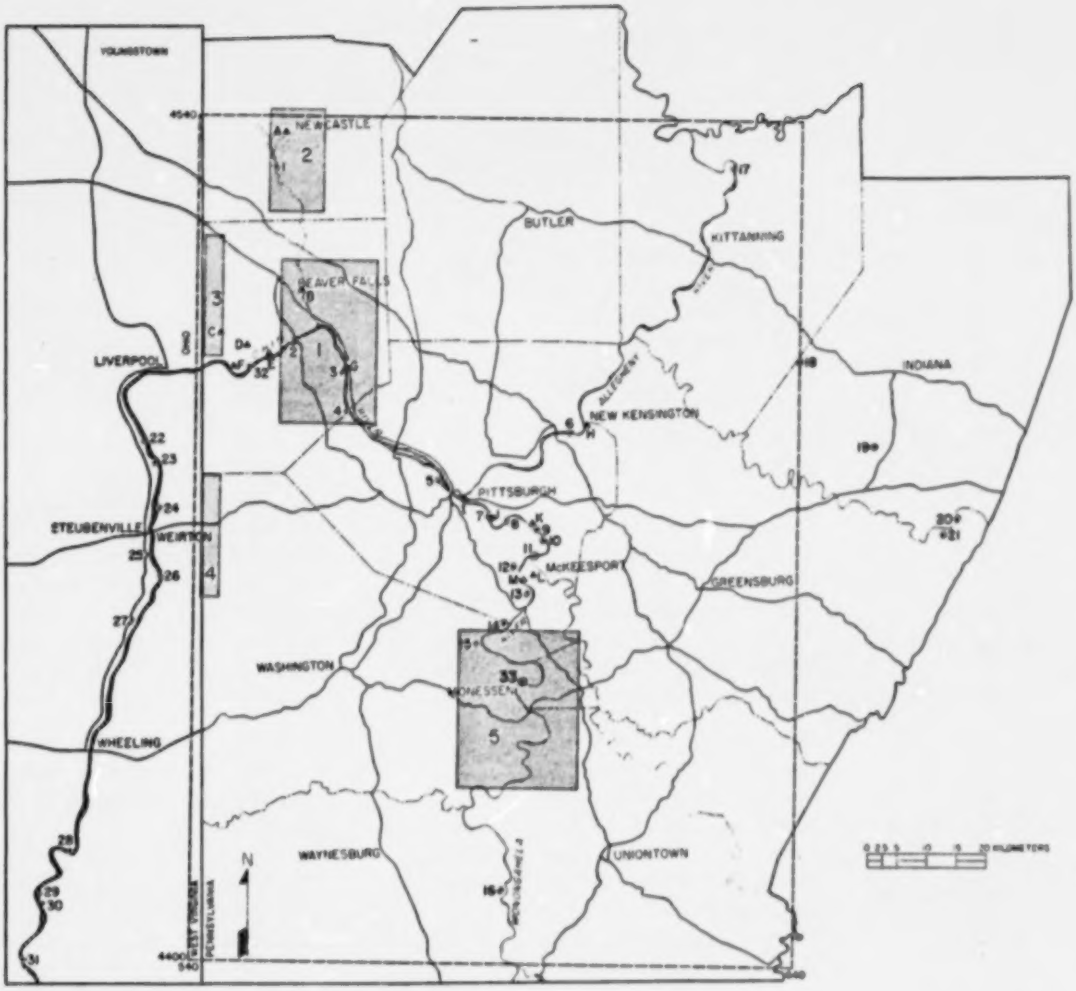

FIGURE I. Map of the Southwest Pennsylvania AQCR and surrounding areas. Dashed lines show the gross grid and shaded areas show the five smaller grids used for dispersion-model calculations. Major SO_2 sources and source complexes are indicated by the numbers 1 through 31 and SO_2 monitor locations used for model validation are indicated by the letters A through M.

TABLE II

LIST OF MAJOR SO_2 SOURCES IN FIGURE I

Source Number	Source Name	UTM Coordinates (m)	
		X	Y
1	Penn Power, West Pittsburgh	553,105	4,531,767
2	St. Joe Minerals	556,065	4,502,301
3	J & L Aliquippa	564,400	4,497,500
4	Duquesne Light, Phillips	565,260	4,491,020
5	Duquesne Light, Brunot Is.	580,680	4,479,680
6	Duquesne Light, Cheswick	602,330	4,487,800
7	J & L Pittsburgh	589,000	4,473,900
8	USS Homestead	592,100	4,473,100
9	USS Edgar Thomson	597,260	4,471,685
10	USS Duquesne	598,324	4,470,025
11	USS National	597,000	4,467,500
12	USS Irvin	593,180	4,465,700
13	USS Clairton	595,500	4,461,500
14	Duquesne Light, Elrama	592,000	4,456,200
15	Penn Power, Mitchell	587,340	4,452,810
16	Hatfield Power	591,570	4,412,040
17	Armstrong Power	628,979	4,531,996
18	Keystone Power	640,141	4,502,155
19	Homer City Power	652,756	4,486,147
20	Seward Power	666,882	4,474,602
21	Conemaugh Power	664,582	4,471,929
22	Ohio Ediwon, Sammis	531,700	4,485,500
23	Ohio Power, Toronto	533,500	4,481,800
24	National Steel, Wierton Div.	534,300	4,474,400
25	Wheeling-Pittsburgh (North)	532,500	4,466,700
26	Wheeling-Pittsburgh (South)	534,600	4,463,300
27	Cardinal Power	530,000	4,455,800
28	Ohio Edison, Burger	520,500	4,417,500
29	Kammer Power	515,320	4,410,320
30	Mitchell Power	515,800	4,408,670
31	PPG	512,600	4,399,600
32	Penn Power, Mansfield	549,049	4,498,067
33	Wheeling-Pittsburgh, Monessen	594,170	4,446,350

TABLE III

LIST OF SO_2 MONITOR SITES IN FIGURE I

Site Symbol	Site Name (Operator)	UTM Coordinates (m)		Site Elevation (m MSL)
		X	Y	
A	New Castle (DER)	554,830	4,537,240	257
B	Beaver Falls (DER)	557,750	4,510,785	220
C	Fairview (Penn Power)	544,820	4,504,390	390
D	Route 68 (Penn Power)	550,720	4,500,640	238
E	West Beaver (Penn Power)	548,950	4,502,000	375
F	Midland (DER)	546,330	4,498,340	249
G	Baden (DER)	565,090	4,498,380	230
H	Logans Ferry (BAPC)	605,154	4,489,115	268
I	Downtown (BAPC)	585,150	4,476,600	256
J	Hazelwood (BAPC)	589,762	4,473,952	284
K	North Braddock (BAPC)	596,680	4,472,835	275
L	Liberty Boro (BAPC)	596,210	4,464,150	340
M	Glassport (BAPC)	594,190	4,463,580	234

eastern Ohio and West Virginia is greatest at or near the western border of the Southwest Pennsylvania AQCR. To obtain preliminary estimates of this impact, we included the two border grids 3 and 4 shown in Figure I in both the annual and short-term model calculations using the 1980 compliance emissions inventories. The annual average calculations showed a maximum concentration of 101.4 micrograms per cubic meter on the Pennsylvania-West Virginia border about 10 kilometers northeast of Weirton, West Virginia. Calculated concentrations are above the annual NAAQS within a narrow border strip approximately 17 kilometers long and 4 kilometers wide extending north and south from the point of the calculated maximum. Sources in eastern Ohio and West Virginia respectively account for about 35 percent and 53 percent of the maximum annual concentration. However, there are some points located within the areas where the calculated concentrations are above the annual SO_2 standard at which sources located in Ohio account for more than 50 percent of the calculated concentrations. The short-term model calculations show a maximum 24-hour average concentration of 425.2 micrograms per cubic meter and a maximum 3-hour average concentration of 2375 micrograms per cubic meter at a point located about 4 kilometers east of the Pennsylvania-West Virginia border and about 10 kilometers southeast of Weirton, West Virginia. Sources in West Virginia account for 83 percent of the calculated 24-hour maximum and for virtually 100 percent of the calculated 3-hour maximum. We also found several other 3-hour cases in 1976 in which the calculated 3-hour maximums in this border area are greater than 2000 micrograms per cubic meter and are produced almost entirely by emissions from sources in West Virginia.

We point out that the model calculations for the border areas described above are preliminary values because they were made using worst-case meteorological conditions selected for other grid areas and therefore may not be representative of the worst-case situations for the border areas. In addition, there are questions about the accuracy of the emissions inventories for the West Virginia and Ohio sources used in the model. Therefore, while we believe the results of our model calculations for the border areas serve to point out potential SO_2 air quality problems, an additional effort beyond the scope of the present study is required to define the magnitude and areal extent of the annual and short-term SO_2 concentrations along the western border of the Southwest Pennsylvania AQCR.

For purposes of validating model calculations made by the LONGZ and SHORTZ computer programs for the Southwest Pennsylvania AQCR, we originally planned to use 1975 emissions inventory, meteorological data and SO_2 monitor data. However, because of deficiencies in the Pennsylvania DER and Allegheny County monitor data for 1975 and problems with emissions inventories, it was necessary to use the 1976/1977 emissions inventory in Appendix C.3 and meteorological data for 1976 and 1977 in combination with SO_2 monitor data for the years 1976 through 1979 in the model validation study. Table IV lists the observed annual average SO_2 concentrations at various monitor sites and the calculated annual average SO_2 concentrations at these monitor sites. The concentrations were calculated by using the LONGZ computer program with the 1976/1977 emissions inventory in Appendix C.3 and the meteorological inputs in Appendixes B.2 and B.3 developed from the 1976 and 1977 hourly observations at the Greater Pittsburgh Airport. As shown in the table, the observed concentrations are less than half of the concentrations calculated at the Baden monitor in 1976 and at the Hazelwood monitor in both 1976 and 1977. We believe the comparison of observed and calculated concentrations at the Baden monitor can probably be disregarded in view of the difference in time between the observation period and the period for which the calculations were made, as well as the 45.7-percent valid data recovery rate at the Baden monitor. We are unable to explain satisfactorily the large model overpredictions at the Hazelwood monitor, except to point out that a detailed analysis of the calculated concentrations in the vicinity of this monitor showed a very large spatial gradient of concentration over an area of about 1 square kilometer. Calculated concentrations equal to the observed concentrations are found within a distance of about 500 meters to the south and northwest of the monitor site.

TABLE IV

COMPARISON OF CALCULATED AND OBSERVED ANNUAL GROUND LEVEL SO_2 CONCENTRATIONS*

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$))	$\frac{\text{Observed}}{\text{Calculated}}$	Calculated Concentration ($\mu g/m3$)	$\frac{\text{Observed}}{\text{Calculated}}$
Baden (DER)	9/78 - 8/79	81.2	153.5	0.53	243.3	0.33
Beaver (DER)	9/78 - 8/79	47.2	43.1	1.10	47.4	1.00
New Castle (DER)	9/78 - 8/79	39.3	29.1	1.35	33.9	1.16
Midland (DER)	1979	78.6	112.5	0.70	120.5	0.65
Fairview (Penn Power)	1977	109.4	77.4	1.41	69.7	1.57
Western Beaver (Penn Power)	1977	85.2	97.5	0.87	85.2	1.00
Route 68 (Penn Power)	1977	101.0	89.0	1.14	81.1	1.24
Liberty Boro (BAPC)	1976	104.0	133.3	0.78	141.1	0.74
Downtown (BAPC)	1976	73.0	75.5	0.97	69.9	1.04
Hazelwood (BAPC)	1976	141.5	354.2	0.40	406.8	0.35

TABLE IV (Continued)

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$)	Observed/Calculated	Calculated Concentration ($\mu g/m^3$)	Observed/Calculated
Glassport (BAPC)	1976	96.0	91.6	1.05	97.7	0.98
North Braddock (BAPC)	1976	91.0	98.4	0.92	112.4	0.81
Logans Ferry (BAPC)	1976	73.0	57.5	1.27	66.8	1.09

*Calculations made using the 1976/1977 emissions inventory with 1976 and 1977 meteorological data.

TABLE OF CONTENTS

Section	Title	Page
	DISCLAIMER	ii
	ACKNOWLEDGEMENTS	iii
	EXECUTIVE SUMMARY	iv
1	INTRODUCTION	1
2	SO_2 EMISSIONS INVENTORY	9
	2.1 SO_2 Industrial Emissions Inventory for 1976/1977	10
	2.2 SO_2 Industrial Compliance Emissions Inventory for 1980	11
	2.3 SO_2 Area Source Emissions Inventory	12
3	METEOROLOGICAL INPUTS	23
	3.1 Meteorological Inputs Required by the Long-Term Model (LONGZ)	23
	3.2 Meteorological Inputs Required by the Short-Term Model (SHORTZ)	30
4	SO_2 DECAY AND BACKGROUND	
	4.1 Adjustment of the Model Concentration Calculations for SO_2 Decay	33
	4.2 Estimates of SO_2 Background Concentration	36
5	LONG-TERM CALCULATIONS	41
	5.1 Calculation Procedures	41
	5.2 Long-Term Calculation Results	46
6	SHORT-TERM MODEL CALCULATIONS	55
	6.1 Calculation Procedures	55
	6.2 Short-Term Calculation Results	58
7	MODEL VALIDATION	68
	7.1 SO_2 Monitor Data Used for Model Validation	69
	7.2 SO_2 Emissions Inventory Data Used for Model Validation	70

TABLE OF CONTENTS (Continued)

Section — Title — Page

7.3 Long-Term Validation Calculations 73
7.4 Short-Term Validation Calculations 75

8 PRELIMINARY CALCULATIONS OF SO_2 CONCENTRATIONS ALONG THE PERIMETER OF THE SOUTHWEST PENNSYLVANIA AQCR 79

8.1 Long-Term Calculations 79
8.2 Short-Term Calculations 81

REFERENCES

Appendix

A MATHEMATICAL MODELS USED TO CALCULATE GROUND-LEVEL CONCENTRATIONS A-1

A.1 Introduction A-1
A.2 Plume-Rise Formulas A-7
A.3 Short-Term Concentration Model A-9
A.4 Long-Term Concentration Model A-16
A.5 Application of the Short-Term and Long-Term Concentration Models in Complex Terrain A-21

B METEOROLOGICAL INPUTS USED IN THE LONG-TERM MODEL CALCULATIONS (BASED ON METEOROLOGICAL OBSERVATIONS MADE AT THE GREATER PITTSBURGH AIRPORT) B-1

B.1 1965 Seasonal and Annual Inputs used for the 1980 Compliance Calculations B-2
B.2 1976 Seasonal and Annual Meteorological Inputs Used for Model Validation Calculations B-9
B.3 1977 Seasonal and Annual Meteorological Inputs used for Model Validation Calculations B-16

TABLE OF CONTENTS (Continued)

Section	Title	Page
C	SO_2 EMISSIONS INVENTORIES	C-1
	C.1 Southwest Pennsylvania AQCR Annual Compliance Emissions Inventory	C-2
	C.2 Southwest Pennsylvania AQCR Short-Term Compliance Emissions Inventory	C-29
	C.3 Allegheny County 1976/1977 Emissions Inventory for Validation Study	C-57
	C.4 Corrections and Changes to the Emissions Inventory	C-80

SECTION 1
INTRODUCTION

This study was originated under EPA Contract No. 68-02-2522 to provide dispersion-model calculations of the air quality impact of future SO_2 emissions in the Southwest Pennsylvania Air Quality Control Region (AQCR) for the years 1980, 1985 and 2000 for use in planning for industrial growth and regulatory activities. During the course of the study, in response to changes in the Clean Air Act, the Scope of Work of the contract was modified to provide for dispersion-model calculations to assist in evaluating changes in the Pennsylvania State Implementation Plan and the attainment or non-attainment of the National Ambient Air Quality Standards within the Beaver Valley and Monongahela Valley Air Basins. This work was continued under EPA Contract No. 68-02-2547, Task Order No. 2 which specifically addressed the requirement for dispersion-model calculations of worst-case annual, 24-hour and 3-hour ground-level SO_2 concentrations, using 1980 compliance emissions inventories, in the Beaver Valley and Monangahela Valley Air Basins.

All of the dispersion model calculations for the study were performed using the LONGZ and SHORTZ computerized models described in "Diffusion Model Calculations of Long-Term and Short-Term Ground-Level Sulfur Dioxide Concentrations in Allegheny County, Pennsylvania" (EPA-903/9-75-018). These models are fully documented in the "User's Instructions for the SHORTZ and LONGZ Computer Programs" (Bjorklund and Bowers, 1979). Figure 1-1 is a map of the Southwest Pennsylvania AQCR showing the various calculation grids used in the study. The dashed line defines the 100 x 140 kilometer gross grid which encloses most of the Southwest Pennsylvania AQCR. This gross grid was used for LONGZ dispersion-model calculations in the beginning of the study to isolate specific areas of high annual average SO_2 concentrations in which more detailed model calculations were required to define the air quality impact of SO_2 emissions

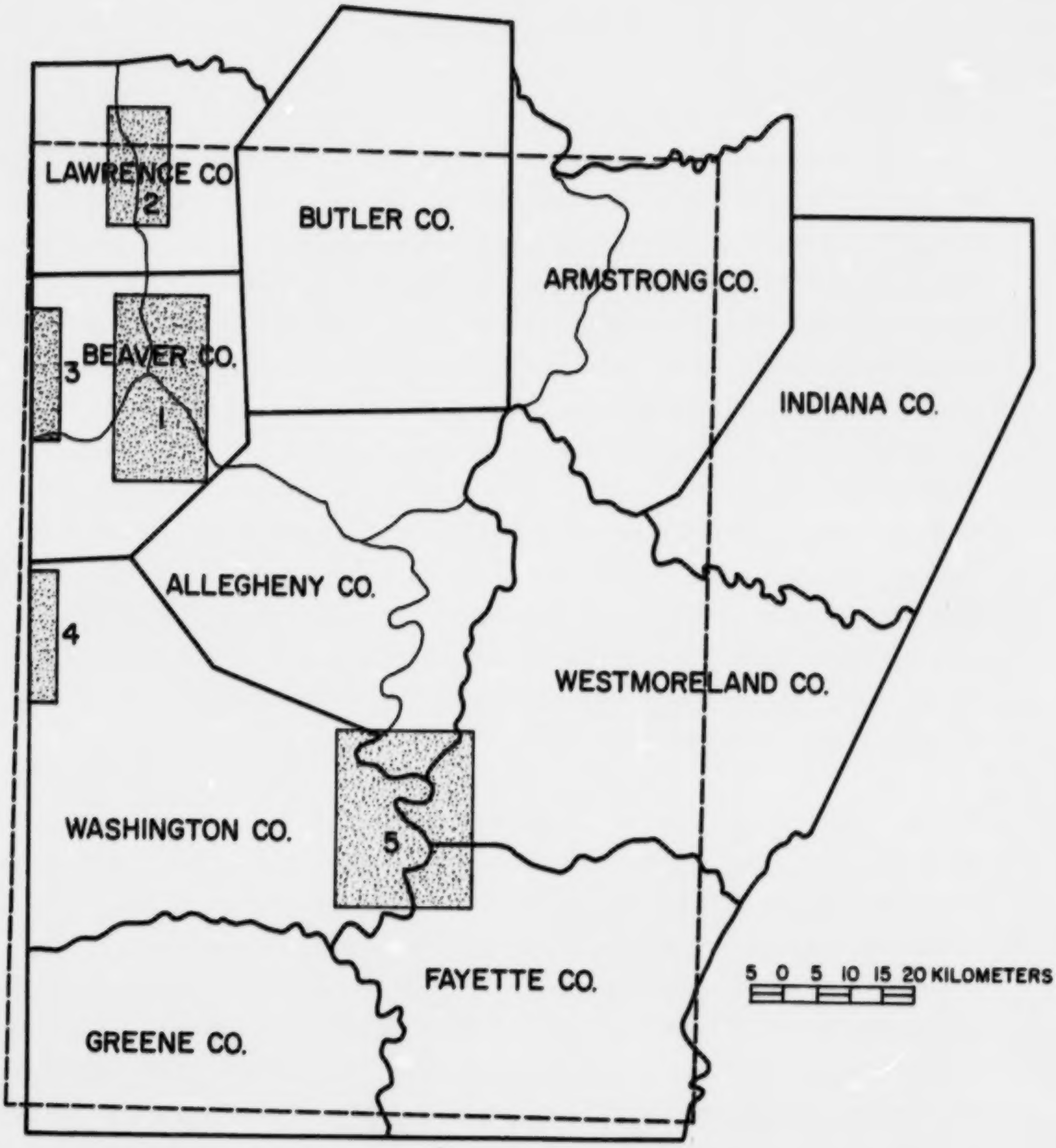

FIGURE 1-1. Southwest Pennsylvania AQCR showing the Beaver grid (1), New Castle grid (2), Northwest Border grid (3), Southwest Border grid (4) and the Monessen grid (5).

from major sources and source complexes. A 5-kilometer spacing of grid points was used for the central 60-by-100 kilometer area of the gross grid and a 10-kilometer spacing was used for the remaining outer portions of the grid. The five shaded areas in Figure 1-1 show the smaller grids used for the detailed dispersion-model calculations with the 1980 compliance emissions inventories in which a 1-kilometer spacing of grid points was employed. The terrain contours for each of the five smaller grids are presented in Figures 1-2 through 1-5. In areas of calculated high concentrations and steep gradients, the grid spacing was further reduced to improve the definition of the concentration field. For example, a 100-meter grid spacing was used in the Baden area and a 500-meter grid spacing was used in the Monessen area (see Figures 5-2 through 5-4).

Emissions inventories for SO_2 sources located within Allegheny County were supplied by the Allegheny County Bureau of Air Pollution Control (BAPC). Emissions inventories for all other SO_2 sources located within the Southwest Pennsylvania AQCR were provided by the Pennsylvania Department of Environmental Resources (DER). Emissions inventories for sources located in eastern Ohio and West Virginia near the western border of the Southwest Pennsylvania AQCR were obtained by EPA Region III from the responsible state agencies in Ohio and West Virginia.

Section 2 of this report contains a description of the 1976/1977 and 1980 SO_2 emissions inventories used in the dispersion-model calculations. Meteorological inputs used in the dispersion-model calculations are described in Section 3. Adjustments made in the model calculations for SO_2 decay and estimates of SO_2 background concentrations are discussed in Section 4. Results of the long-term and short-term dispersion-model calculations made using the 1980 compliance emissions inventories are presented in Sections 5 and 6, respectively. Model validation calculations and comparisons with SO_2 monitor data are discussed in Section 7. Section 8 contains a discussion of preliminary calculations of SO_2 concentrations along the western perimeter of the Southwest Pennsylvania AQCR. There are three appendices to this report. Appendix A contains a description of

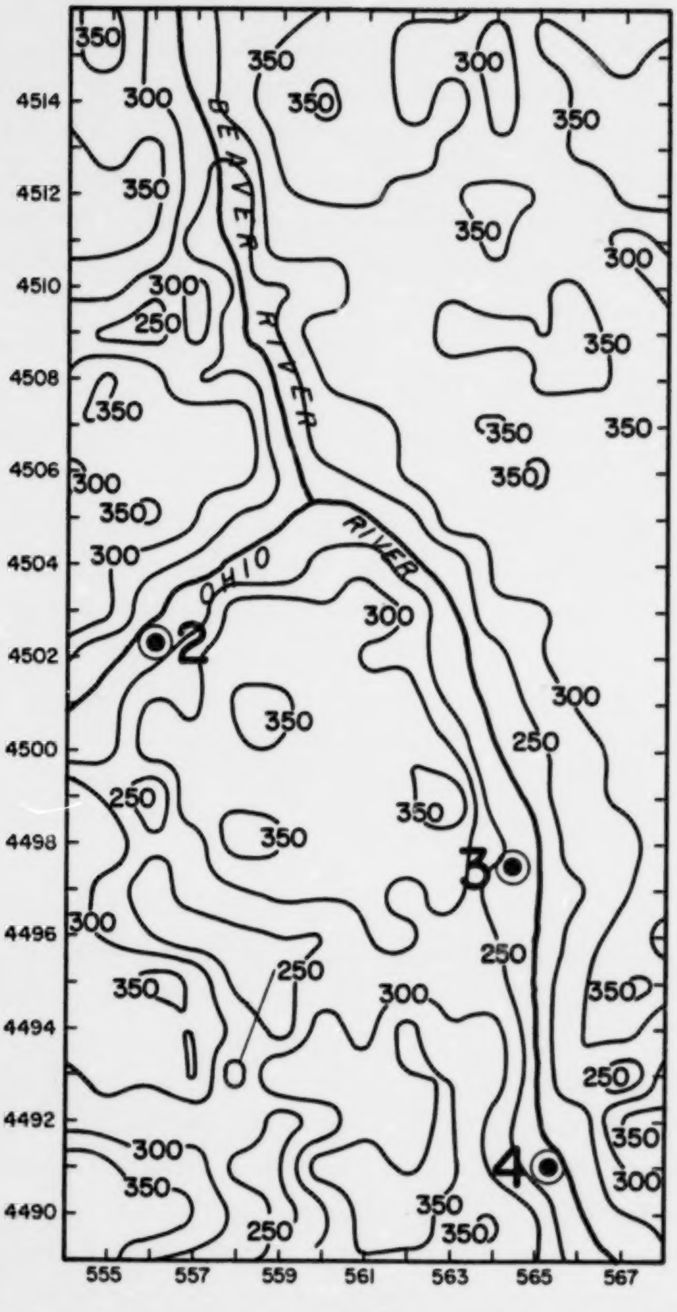

FIGURE 1-2. Terrain contours in meters above Mean Sea Level for the Beaver grid. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillips Plants.

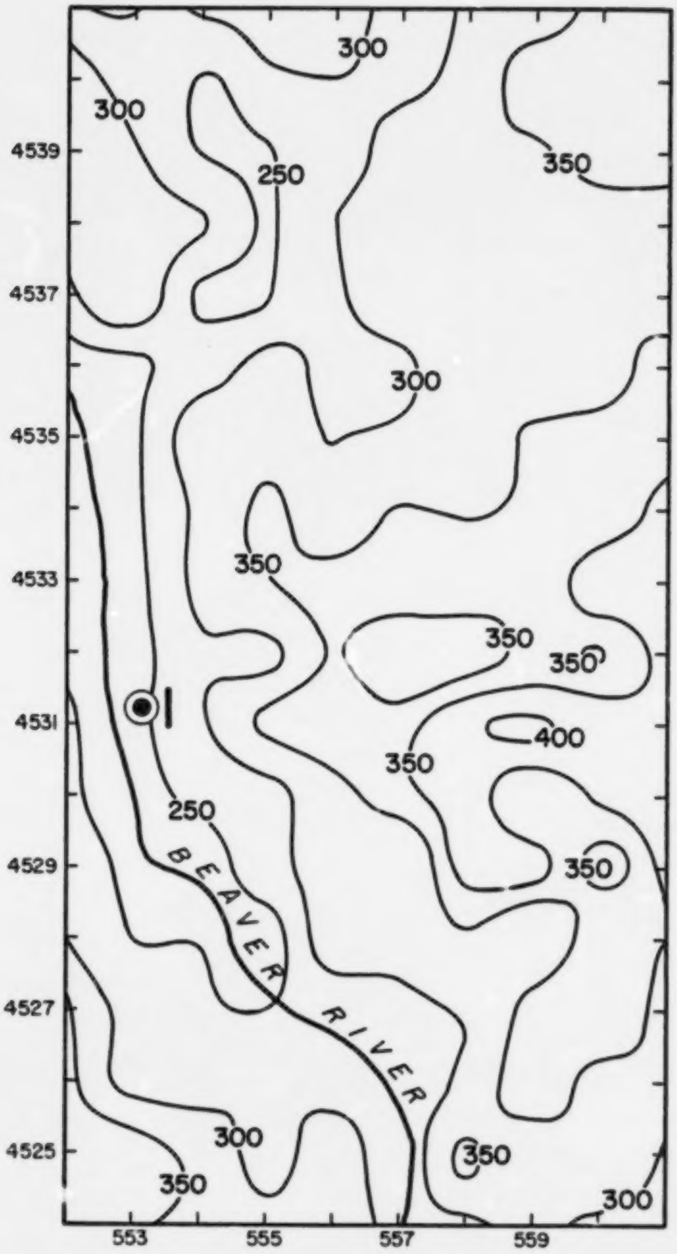

FIGURE 1-3. Terrain contours in meters above Mean Sea Level for the New Castle grid. The number 1 refers to the Penn Power, West Pittsburgh Plant.

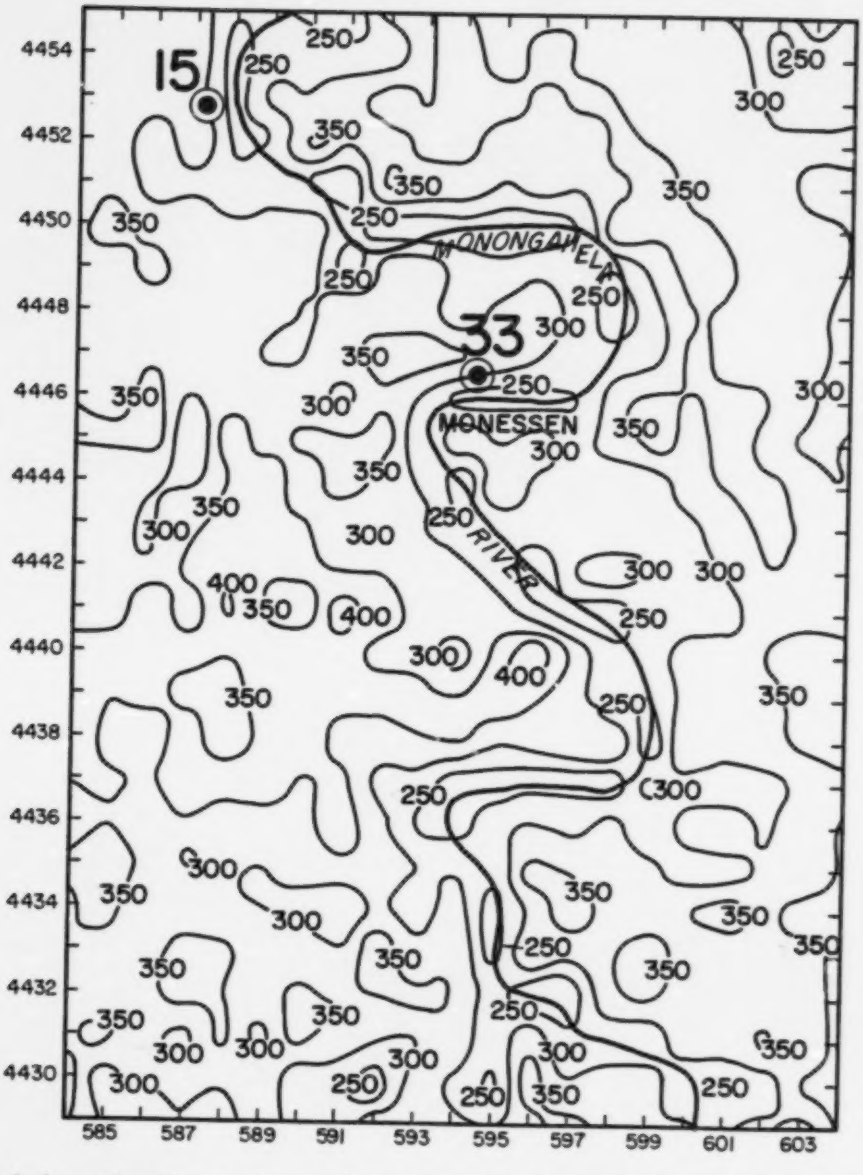

FIGURE 1-4. Terrain contours in meters above Mean Sea Level for the Monessen grid. The number 15 refers to the Penn Power, Mitchell Plant.

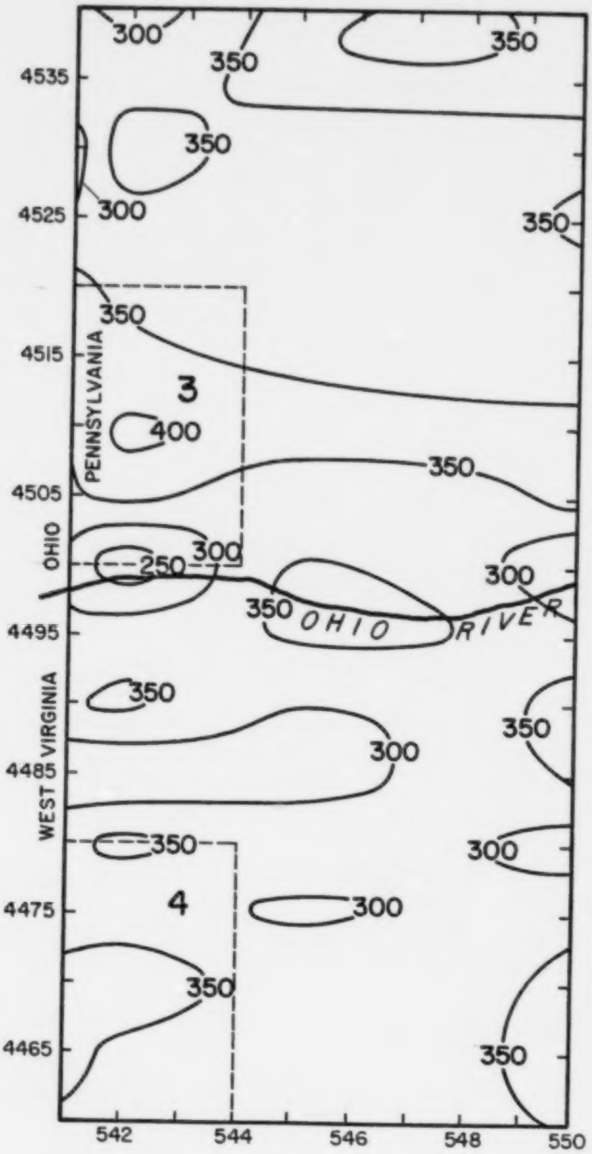

FIGURE 1-5. Terrain contours in meters above Mean Sea Level for the Northwest (3) and Southwest (4) Border grids.

the LONGZ and SHORTZ dispersion models used in the study. Tabular summaries of the meteorological inputs used in the LONGZ model calculations for the compliance cases and the validation study are contained in Appendix B. The SO_2 emissions inventories used in the study are given in Appendix C.

SECTION 2

SO_2 EMISSIONS INVENTORIES

The 1976/1977 and 1980 (compliance) SO_2 emissions inventories used with the LONGZ and SHORTZ dispersion models were developed from information supplied by the following agencies:

- Pennsylvania Department of Environmental Resources
- Allegheny County Bureau of Air Pollution Control
- West Virginia Air Pollution Control Commission
- Ohio Environmental Protection Agency
- EPA Region V
- EPA Region III

Information pertaining to industrial point sources located in the Beaver Valley Air Basin, the Monongahela Valley Air Basin and to other sources in Pennsylvania located outside Allegheny County was obtained from the automated emissions inventory files of the Pennsylvania Department of Environmental Resources. Emissions data for SO_2 sources located within Allegheny County were obtained from the Allegheny County Bureau of Air Pollution Control. Data pertaining to SO_2 sources located in the West Virginia Panhandle were obtained from the West Virginia Air Pollution Control Commission by EPA Region III. After reviewing the draft final report, the Pennsylvania Department of Environmental Resources and the West Virginia Air Pollution Control Commission made some revisions in the 1980 compliance emissions inventory. These revisions,which were received after the dispersion-model calculations had been completed, are listed in Appendix C.4 for reference. Emissions data for the SO_2 sources in Ohio along the Ohio River near the Pennsylvania border were obtained principally by EPA Region III from the Ohio Environmental Protection Agency and EPA Region V.

2.1 SO_2 INDUSTRIAL EMISSIONS INVENTORY FOR 1976/1977

The 1976 and 1977 SO_2 emissions inventory data for the Southwest Pennsylvania AQCR were reviewed by the H. E. Cramer Company and missing data, questionable parameter values and other potential problems were noted. The year 1976 was originally intended to be the base year for the initial modeling of SO_2 emissions. However, principally because of the lack of valid air quality measurements and to some extent the unavailability of emissions data, the emissions data for the two years 1976 and 1977 were combined to develop the SO_2 emissions inventory used with the initial executions of the models. The SO_2 emissions inventory parameters for each source that are required to execute the LONGZ and SHORTZ dispersion models are:

- Source Location (UTM coordinates)
- Plant Grade Elevation
- SO_2 Emission Rate
- Source Type (Stack)
    - Stack Exit Gas Temperature
    - Stack Exit Volume
    - Stack Exit Diameter
    - Stack Height
- Source Type (Building or Area)
    - Source Length
    - Source Width
    - Source Height

The SO_2 emissions inventories obtained from the various agencies were converted to standard metric units and forwarded with the list of questions and missing data to the originating agencies for their review as to accuracy and completeness. The short-term emissions inventory required additional work in developing appropriate emissions rates from the available data. This process took several months and required a number of iterations in order to determine whether plant operating levels, maximum allowable emissions or rated boiler capacities should be used in establishing short-term SO_2 emission rates.

2.2 SO_2 INDUSTRIAL COMPLIANCE EMISSIONS INVENTORY FOR 1980

Upon completion of the 1976/1977 emissions inventory, the various agencies involved started to develop an emissions inventory for the years 1980-1982 to be used in the dispersion modeling of future years for determining compliance with air quality standards and for developing control strategies. As this task was nearing completion, the goals of the study were modified to reflect the changes in the environmental regulations and the need for using dispersion-model calculations to define the areas of attainment and non-attainment for SO_2 within the Southwest Pennsylvania AQCR. Because of these modifications in the goals of the study, emphasis was placed on the development of an SO_2 emissions inventory for the year 1980 and a specific review of the inventory for 1980 was conducted by the Pennsylvania Department of Environmental Resources and the Allegheny County Bureau of Air Pollution Control. The 1980 emissions inventory for SO_2 sources located within Allegheny County presented a special problem for the Bureau in that SO_2 emissions are heavily dependent upon the operations of several integrated steel mills located within the County and the availability and mix of the fuels consumed by these mills. For example, an individual source may use fuels that vary from natural gas with a very low sulfur content to coal with a sulfur content of a few percent which results in a very wide range of possible SO_2 emissions. The regulations of the Allegheny County Bureau of Air Pollution Control allow individual sources to burn the mixed fuels available at any given time. For these reasons, considerable judgement is required in arriving at a reasonable estimate of the fuel mixture to be used in determining the SO_2 emission rates for both short-term and annual model calculations. Therefore, the 1980 compliance SO_2

emissions inventory for sources located within Allegheny County reflects the Allegheny County Bureau of Air Pollution Control's best estimate of the mixture of available fuels which would be consumed during 1980.

The 1980 compliance emissions inventory for SO_2 sources located in West Virginia is based upon the state's Regulation X and estimates by the West Virginia Air Pollution Control Commission of the actual operating levels for 1980.

The 1980 compliance emissions inventory for SO_2 sources located in Ohio is unchanged from the 1976/1977 SO_2 emission inventory as neither EPA Region III nor the H. E. Cramer Company, Inc. was able to obtain estimates of the SO_2 emissions from the Ohio sources for 1980. The 1976/1977 inventory was reviewed by the Ohio EPA and updated to reflect changes in operating levels and emissions.

2.3 SO_2 AREA SOURCE EMISSIONS INVENTORY

During the development of the industrial SO_2 emissions inventory, estimates of the area source SO_2 emissions inventory were also developed using the techniques described below. Area sources were divided into three major categories:

- Mobile sources
- Space heating
- Industrial and commercial sources excluded from the industrial emissions inventory

2.3.1 Mobile Sources

The four types of mobile sources that were considered in developing the area source emissions data were:

- Motor vehicles
- Railroads
- River vessels
- Aircraft

Daily motor vehicle mileage data for Pittsburgh and the six counties comprising the Southwest Pennsylvania AQCR were obtained from EPA Region III and the Southwest Pennsylvania Regional Planning Commission (RPC). Both sets of data are for calendar 1972. The EPA data are allocated by type of vehicle. The RPC data are in the form of total daily vehicle miles per traffic zone and traffic-zone area. Table 2-1 presents the EPA data and total daily vehicle mileage estimates developed from the RPC traffic zone data. The total daily mileage estimates in the table for the Southwest Pennsylvania AQCR given by the two data sets differ by less than 1 percent. Differences in the totals for the individual areas range from about 16 to 25 percent.

Estimates of the SO_2 emissions from the exhaust of motor vehicles were obtained by using the vehicle mileage data by vehicle types in Table 2-2 supplied by EPA Region III with the following emissions factors published by EPA (AP-42, Supplement No. 5, December 1975):

- 0.18 grams per mile for light duty vehicles
- 0.36 grams per mile for heavy duty gasoline powered vehicles
- 2.80 grams per mile for heavy duty diesel powered vehicles

Estimates thus obtained of the SO_2 emissions from motor vehicle exhaust for Pittsburgh and the six county areas are shown in Table 2-2.

SO_2 emissions from the operation of railroads and river vessels were obtained by using the emission factors published by EPA (AP-42 Supplement No. 4, December 1975) and fuel consumption data obtained from the Southwest Pennsylvania RPC. The reported annual fuel oil consumption is

TABLE 2-1

1972 DAILY VEHICLE MILEAGE FOR THE SOUTHWEST PENNSYLVANIA INTRASTATE AIR QUALITY CONTROL REGION

Area	EPA Region III Data				SWPRC Data
	Light Duty Vehicles	Heavy Duty Vehicles	Diesel Vehicles	Total All Vehicles	All Vehicles
Pittsburgh	3,458,169	177,722	66,646	3,702,537	3,110,004
Allegheny County	13,578,293	450,671	171,627	14,200,591	13,351,328
Butler County	2,086,405	34,133	12,800	2,133,338	2,187,730
Armstrong County	1,029,916	44,779	17,475	1,092,170	936,865
Westmoreland County	4,931,992	138,280	51,215	5,121,487	5,438,732
Washington County	3,015,601	62,049	24,820	3,102,470	3,263,532
Beaver County	1,905,955	80,675	30,253	2,016,883	2,347,737
TOTAL (All Areas)	26,548,162	810,587	308,190	27,666,939	27,498,927

TABLE 2-2

ANNUAL SO_2 EMISSIONS FROM VEHICLES FOR SELECTED AREAS OF THE SOUTHWEST PENNSYLVANIA AQCR ($g/sec/km^2$)

Area (km^2)	Light Duty Vehicles	Heavy Duty Vehicles	Diesel Vehicles	Total
Incorporated Pittsburgh (142)	0.051	0.005	0.015	0.071
Allegheny County (1886)	0.015	0.001	0.003	0.019
Butler County (2057)	0.002	0.000	0.000	0.002
Armstrong County (1689)	0.001	0.000	0.000	0.002
Westmoreland County (2652)	0.004	0.000	0.001	0.005
Washington County (2219)	0.002	0.000	0.000	0.003
Beaver County (1139)	0.003	0.000	0.001	0.005

25×10^6 gallons for railroads and 7×10^6 gallons for river vessels. The EPA emission factor for railroad locomotives is 57 pounds of SO_2 per 1000 gallons of fuel; the corresponding factor for commercial steamships is 27 pounds of SO_2 per 1000 gallons of fuel oil. These data yield estimates of the total SO_2 emissions from railroads of 712.5 tons per year and 94.5 tons per year from river vessels. Assuming that the total combined railroad and river vessel SO_2 emissions of 807.0 tons per year occur in Allegheny County and Beaver County within a 1-kilometer corridor along the Ohio, Allegheny and Monongahela Rivers, the area-source SO_2 emissions from railroad and river vessels are approximately 4 tons per year per square kilometer.

2.3.2 Space Heating

SO_2 emissions from space heating were estimated using the emission factor of 0.6 pounds per 10^6 cubic feet of natural gas published by EPA (AP-42, February, 1973) and the estimated quantities of fuels being consumed within the Southwest Pennsylvania AQCR. According to the Brown Directory (Natural Gas, Operating Gas Companies, 1973), there are seven natural gas companies serving the region as shown in Table 2-3. Distributing the natural gas being used for residential and commercial heating on a population basis results in the SO_2 emission rates by counties given in Table 2-4. Heat for the large buildings in downtown Pittsburgh is provided by central steam plants. This area therefore uses relatively small amounts of natural gas for space heating.

Coal and oil are not considered to be primary fuels for residential or commercial space heating. According to the Minerals Industry Report, 64.5×10^6 tons of bituminous and lignite coal were consumed in 1972 in the Commonwealth of Pennsylvania. The industrial/commercial SO_2 emissions inventory for the Southwest Pennsylvania AQCR accounts for 48.0×10^6 tons of coal per year which is approximately 75 percent of the above 1972 annual coal consumption in the Commonwealth. The Minerals Industry report also estimates that 64.1×10^6 tons of coal were consumed in

TABLE 2-3

SUMMARY OF NATURAL GAS SOLD IN THE SOUTHWEST PENNSYLVANIA AQCR IN 1973

Type of Customer	Number of Customers	Quantity of Gas (10^6 Cubic Feet)
Residences with Heat	876,182	154,327
Residences without Heat	74,316	1,639
Commercial	68,057	67,849
Industrial	1,031	182,258
Total	1,019,586	416,916

TABLE 2-4

SO_2 EMISSIONS FROM NATURAL GAS SPACE HEATING BY COUNTY

County	Population	Percent of Total Population	Natural Gas Consumed (10^6 cubic feet)	Emissions (tons/yr)
Allegheny	1,605,016	53.8	120,416	36.1
Lawrence	107,374	3.6	8,057	2.4
Beaver	208,418	7.0	15,667	4.7
Greene	36,090	1.2	2,686	0.8
Fayette	154,667	5.2	11.638	3.5
Indiana	79,451	2.7	6,043	1.8
Westmoreland	376,935	12.6	28,200	8.5
Butler	127,941	4.3	9.624	2.9
Washington	210,876	7.1	15,891	4.8
Armstrong	75,590	2.5	5,595	1.7
Totals	2,982,358	100.0	223,812	67.2

1972 by industry and utilities in the Commonwealth of Pennsylvania. The annual consumption of bituminous and lignite coal during 1972 by other users in the Commonwealth is therefore 0.4×10^6 tons. We assume that 75 percent of this coal (0.3×10^6 tons) is used in the Southwest Pennsylvania Region and that one-half of this amount (0.15×10^6 tons) is consumed in hand-fired burners used for space heating. The area included in the Southwest Pennsylvania Region is approximately 1.75×10^4 square kilometers. The total annual consumption of coal used for space heating is therefore about 9 tons per square kilometer. If the average sulfur content of this coal is 5 percent, the corresponding annual SO_2 emissions in the Southwest Pennsylvania Region due to the use of coal for space heating are about 0.8 tons per square kilometer.

The Bureau of Statistics, Research and Planning of the Commonwealth of Pennsylvania reports that $384{,}636 \times 10^3$ gallons of fuel oils were distributed in the Southwest Pennsylvania AQCR during 1974. The emissions inventory accounts for $254{,}019 \times 10^3$ gallons which leaves $130{,}344 \times 10^3$ gallons for consumption by residential and commercial users. The natural gas industry reports that they serve 74,316 customers who do not use gas for space heating. The assumption that all of these customers are using fuel oil for space heating in private dwellings leads to an estimated consumption of $68{,}464 \times 10^3$ gallons of fuel oil or approximately half of the unaccounted fuel. It is likely that there are additional consumers not included in the gas industries report and that some of the listed and unlisted non-natural gas consumers are classified as commercial users. Therefore, we have put all of the unaccounted fuel oil into area-source space heating. Using the emission factor of 71 pounds per 1,000 gallons of fuel oil with 0.5-percent sulfur for commercial burners published by EPA (AP-42 February, 1972) results in a total emission rate of 4627 tons per year or 0.39 tons per year per square kilometer.

2.3.3 Aircraft Emissions

SO_2 emissions were estimated for the Greater Pittsburgh Airport and the Allegheny County Airport using the emissions factors published by EPA (AP-42, April, 1973) and the aircraft operations by type reported for FAA operated towers during 1975. Table 2-5 gives the reported operation from each airport tower. Aircraft operations at the Greater Pittsburgh Airport were assumed to be allocated as follows:

- Air Carrier -- 10% Heavy Aircraft
  60% Long Range Aircraft
  30% Medium Range Aircraft

- Air Taxi -- 5% Helicopter
  47.5% General Aviation Turboprop
  47.5% General Aviation Piston

- General Aviation -- 20% Business Jet
  20% General Aviation Turboprop
  60% General Aviation Piston

- Military -- 80% Military Transport
  20% Military Jet

The estimated SO_2 emissions rate is 188.5 tons per year for aircraft operations at the Greater Pittsburgh Airport.

Aircraft operations at the Allegheny County Airport were assumed to be allocated as follows:

- Air Carrier -- 100% Medium Range Aircraft

TABLE 2-5

AIRCRAFT OPERATIONS REPORTED FOR 1975
(Takeoff/Landing Cycles)

Greater Pittsburgh Airport	
Air Carrier	172,331
Air Taxi	54,230
General Aviation	46,179
Military	12,425
Allegheny County Airport	
Air Carrier	5
Air Taxi	566
General Aviation	168,378
Military	1,497

- Air Taxi -- 50% General Aviation Turboprop
  50% General Aviation Piston
- General Aviation -- 80% General Aviation Single Engine Piston
  10% General Aviation Turboprop
  10% General Aviation Dual Engine Piston
- Military -- 50% Military Transport
  50% Helicopter

The estimated SO_2 emissions rate is 10.0 tons per year for aircraft operations at the Allegheny County Airport.

SECTION 3
METEOROLOGICAL INPUTS

3.1 METEOROLOGICAL INPUTS REQUIRED BY THE LONG-TERM MODEL (LONGZ)

Meteorological inputs required by the long-term dispersion model LONGZ described in Appendix A were principally obtained from the seasonal and annual distributions of wind speed and wind direction, classified according to the Pasquill stability categories, for the Greater Pittsburgh Airport. These distributions were developed from the surface observations using the definitions of Pasquill stability categories given by Turner (1964), which are based upon solar radiation (insolation) and wind speed. The thermal stratifications represented by the various Pasquill stability categories are:

- A — Very unstable
- B -- Unstable
- C -- Slightly unstable
- D -- Neutral
- E -- Slightly stable
- F -- Stable

Figure 3-1 shows the 1965 annual frequency distribution of wind direction at the Greater Pittsburgh Airport. Inspection of the figure reveals that most frequent winds at the Greater Pittsburgh Airport are from the west. The 1965 seasonal wind distributions for the Greater Pittsburgh airport are presented in Appendix B.1.

In the dispersion models described in Appendix A, the variation with height of the wind speed in the surface mixing layer is assumed to follow a wind-profile exponent law of the form

$$\bar{u}\{z\} = \bar{u}\{z_R\}\left(\frac{z}{z_R}\right)^p \qquad (3-1)$$

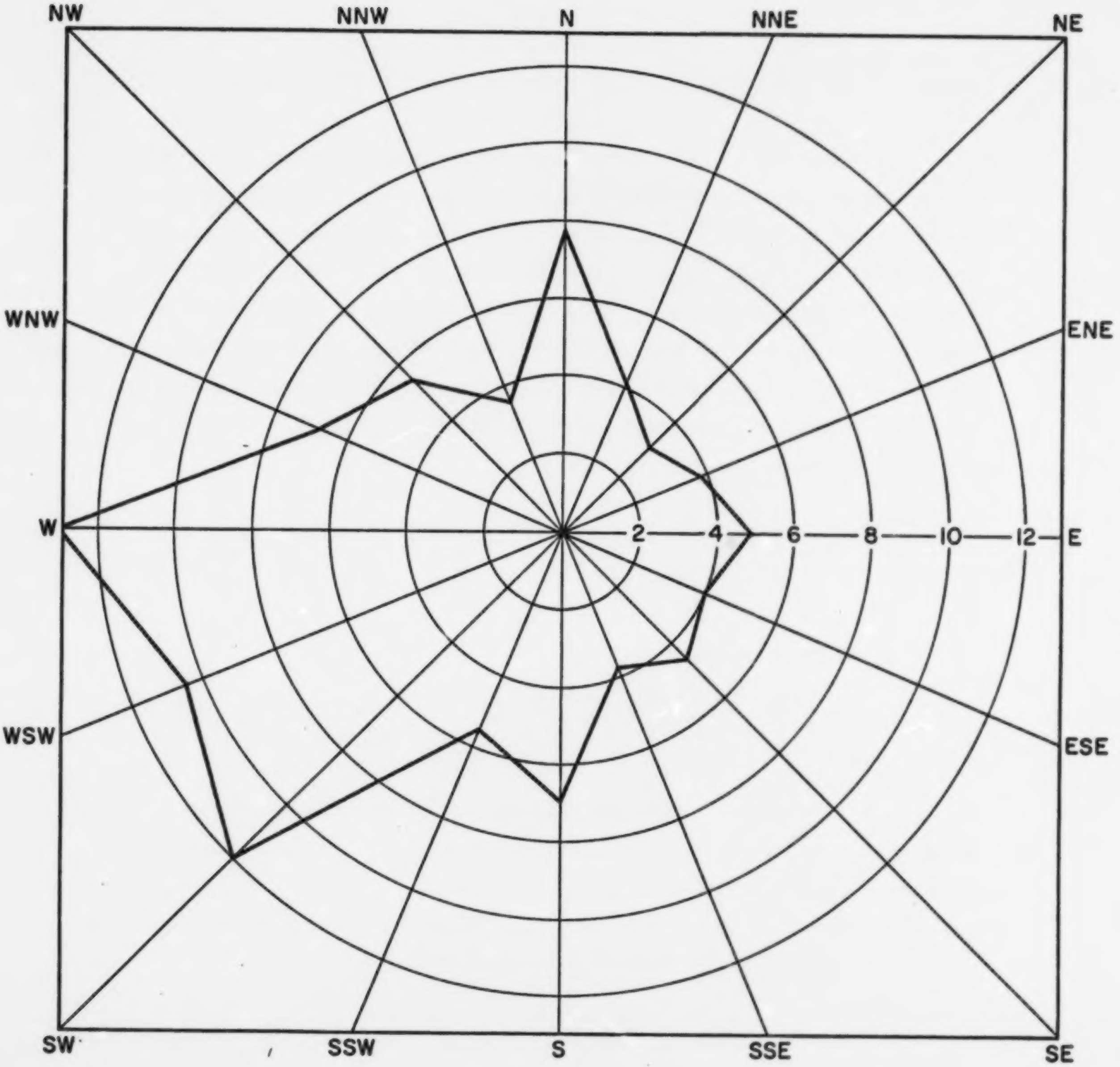

FIGURE 3-1. Annual frequency distribution of wind direction obtained from the 1965 surface observations at the Greater Pittsburgh Airport. Percent frequency scale is shown at right center.

where

$\bar{u}\{z\}$ = wind speed at height z above the surface

$\bar{u}\{z_R\}$ = wind speed at a reference height z_R above the surface

p = wind-profile exponent

In the case of discharges from tall stacks, as discussed in Sections A.3 and A.5 of Appendix A, the wind-profile exponent law is used to adjust the mean wind speed from the reference (airport) measurement height to the stack height for the plume rise calculations, and to the plume stabilization height for the concentration calculations. In the case of low-level emissions, which are generally treated as building sources, the wind-profile exponent law is similarly used to obtain the wind speed at the assigned source height which depends on the vertical dimensions of the buildings or other structures. If the assigned source height is below the reference height, the wind speed at the reference height is used in the model calculations. Values for the wind-profile exponent p assigned to the various combinations of wind speed and stability for the long-term calculations are listed in Table 3-1. These exponent values are based on the results obtained by DeMarrais (1959) and Cramer, et al., (1972).

Our vertical expansion (σ_z) curves, which include the effects of the initial vertical plume or building dimension, relate the vertical turbulent intensity directly to plume growth (see Equation (A-13) of Appendix A). Table 3-2 lists the values of the standard deviation of the wind elevation angle σ_E' corresponding to the Pasquill stability categories for rural and urban areas. The rural σ_E' values are based in part on the measurements of Luna and Church (1972) and are consistent with the σ_E' values implicit in the vertical expansion curves presented by Pasquill (1961). In order to adjust for the effects of surface roughness elements and heat sources, the σ_E' values for the stability category one step more unstable than the indicated stability category are used in the calculations for urban areas. (The entire Southwest Pennsylvania AQCR was considered to

TABLE 3-1

WIND-PROFILE EXPONENTS USED IN THE ANNUAL AVERAGE CONCENTRATION CALCULATIONS

Pasquill Stability Category	Wind-Speed Category (m/sec)*					
	0.0-1.5	1.6-3.1	3.2-5.1	5.2-8.2	8.3-10.8	>10.8
A	0.10	0.10	--	--	--	--
B	0.10	0.10	0.10	--	--	--
C	0.20	0.15	0.10	0.10	0.10	--
D	0.25	0.20	0.15	0.10	0.10	0.10
E	0.30	0.25	0.20	--	--	--

*Measurement height is 6.1 meters above the ground surface.

TABLE 3-2

VERTICAL TURBULENT INTENSITIES FOR RURAL AND URBAN AREAS

Pasquill Stability Category	σ'_E (radians)	
	Rural	Urban
A	0.1745	0.1745
B	0.1080	0.1745
C	0.0735	0.1080
D	0.0465	0.0735
E	0.0350	0.0465
F	0.0235	--

be an urban area in the dispersion model calculations described in this report) A procedure of this type is suggested by Calder (1971), Bowne (1974) and others. The E and F stability categories are combined in urban areas because we believe that the effects of surface roughness elements and heat sources are incompatible with the minimal turbulent mixing associated with the Pasquill stability category F.

The height of the top of the surface mixing layer is defined as the height at which the vertical intensity of turbulence becomes effectively zero. This condition is fulfilled when the vertical turbulent intensity is of the order of 0.01 radians or smaller. Because direct measurements of the intensity of turbulence are not routinely made, indirect indicators such as discontinuities in the vertical wind and temperature profiles must be used to estimate the depth of the surface mixing layer. In the simplest case, the base of an elevated inversion layer is usually assumed to represent the top of the surface mixing layer. However, even with a surface-based inversion, a shallow mechanical mixing layer will always be present due to surface roughness elements and, in urban areas, surface heat sources.

Holzworth (1972) has developed a procedure for estimating early morning and afternoon mixing depths for urban areas from rawinsonde observations and surface temperature measurements. Tabulations of daily observations of the depth of the surface mixing layer, developed by using the Holzworth (1972) procedures, are available for most rawinsonde stations operated by the National Weather Service. For the annual and seasonal concentration calculations, we analyzed seasonal tabulations of daily observations of mixing depth and average surface wind speed at the Greater Pittsburgh Airport for the period 1960 through 1964 (Environmental Data Service, 1966) in order to determine seasonal median early morning and afternoon mixing depths for each wind-speed category. The median afternoon mixing depths were assigned to the A, B and C stability categories; the median early-morning mixing depths were assigned to the combined E and F stability categories and the median early morning and afternoon mixing depths were averaged and assigned to the D stability category. Table 3-3 gives

TABLE 3-3

MIXING-LAYER DEPTHS IN METERS USED IN THE ANNUAL CONCENTRATION CALCULATIONS

Pasquill Stability Category	Wind-Speed Category (m/sec)					
	0.0-1.5	1.6-3.1	3.2-5.1	5.2-8.2	8.3-10.8	>10.8
(a) Winter						
A	500	650	--	--	--	--
B	500	650	710	--	--	--
C	500	650	710	710	710	--
D	320	470	670	710	710	710
E	140	290	630	--	--	--
(b) Spring						
A	1530	1530	--	--	--	--
B	1530	1530	1530	--	--	--
C	1530	1530	1530	1530	1530	--
D	825	920	1030	1415	1530	1530
E	120	310	530	--	--	--
(d) Summer						
A	1730	1730	--	--	--	--
B	1730	1730	1730	--	--	--
C	1730	1730	1730	1730	1730	--
D	960	1025	1235	1295	1295	1295
E	190	320	740	--	--	--
(d) Fall						
A	1230	1230	--	--	--	--
B	1230	1230	1230	--	--	--
C	1230	1230	1230	1230	1230	--
D	685	740	970	1190	1230	1230
E	140	250	710	--	--	--

the seasonal median mixing depths for the joint combinations of the wind-speed and stability categories determined for the Pittsburgh area.

The Briggs (1971) plume-rise formulas given in Section A.2 of Appendix A require the ambient air temperature as an input. For the seasonal concentration calculations, seasonal average afternoon temperatures measured at the Greater Pittsburgh Airport during the period 1963 through 1972 were assigned to the A, B and C stability categories; average morning and evening temperatures were assigned to the D stability category; and average nighttime temperatures were assigned to the combined E and F categories. Table 3-4 lists the ambient air temperatures used in the long-term calculations.

The Briggs (1971) plume-rise formulas given in Section A.2 of Appendix A also require the vertical potential temperature gradient as an input. Table 3-5 lists the vertical potential temperature gradients used in the long-term concentration calculations. The potential temperature gradients in Table 3-5 were assigned on the basis of the Turner (1964) and Pasquill (1961) definitions of the Pasquill stability categories, the measurements of Luna and Church (1972), and our own previous experience.

3.2 METEOROLOGICAL INPUTS REQUIRED BY THE SHORT-TERM MODEL (SHORTZ)

Meteorological inputs required by the short-term dispersion model SHORTZ were principally obtained from the hourly surface observations and the twice-daily rawindsonde data for the Greater Pittsburgh Airport. The Pasquill stability categories were determined using the Turner (1964) procedures. Table 3-6 lists the lateral turbulent intensities for rural and urban areas by Pasquill stability category which were used in the short-term model calculations. The actual hourly values of all meteorological inputs used with the short-term model are described in Section 6.1.

TABLE 3-4

AMBIENT AIR TEMPERATURES USED IN THE ANNUAL AVERAGE CONCENTRATION CALCULATIONS

Pasquill Stability Category	Ambient Air Temperature (^{o}K)			
	Winter	Spring	Summer	Fall
A	273.2	287.0	298.3	289.5
B	273.2	287.0	298.3	298.5
C	273.2	287.0	298.3	298.5
D	271.2	283.7	294.4	286.3
E	269.7	280.3	290.7	282.4

TABLE 3-5

VERTICAL POTENTIAL TEMPERATURE GRADIENTS IN DEGREES KELVIN PER METER USED IN THE ANNUAL AVERAGE CONCENTRATION CALCULATIONS

Pasquill Stability Category	Wind-Speed Category (m/sec)					
	0.0-1.5	1.6-3.1	3.2-5.1	5.2-8.2	8.3-10.8	>10.8
A	0.000	0.000	--	--	--	--
B	0.000	0.000	0.000	--	--	--
C	0.000	0.000	0.000	0.000	0.000	--
D	0.015	0.010	0.005	0.003	0.003	0.003
E	0.030	0.020	0.015	--	--	--

TABLE 3-6

LATERAL TURBULENT INTENSITIES FOR RURAL AND URBAN AREAS

Pasquill Stability Category	σ'_A (radians)	
	Rural	Urban
A	0.2495	0.2495
B	0.1544	0.2495
C	0.1051	0.1544
D	0.0665	0.1051
E	0.0501	0.0665
F	0.0336	--

SECTION 4

SO_2 DECAY AND BACKGROUND

4.1 ADJUSTMENT OF THE MODEL CONCENTRATION CALCULATIONS FOR SO_2 DECAY

During atmospheric transport and dispersion, some of the SO_2 initially emitted from stacks and other sources is oxidized to form sulfates. Because the oxidation process reduces the total amount of SO_2, it is necessary to make allowance for this depletion in the model calculations to preclude overestimation of the ground-level SO_2 concentrations. This is accomplished through the use of an exponential decay term as a direct multiplier of the source strength used in the model calculations. The mathematical expression for SO_2 decay is of the form

$$Q\{t\} = Q\{t=0\}\ e^{-\lambda t} \tag{4-1}$$

where

$Q\{t\}$ = adjusted source strength at time t

$t = x/\bar{u}$

x = downwind distance from the source

$\bar{u}$ = mean wind speed

$Q\{t=0\}$ = initial source strength

λ = SO_2 decay rate

In the above expression, the decay or loss of SO_2 through oxidation is assumed to be represented by a first order reaction (Alkezwenny and Powell, 1977). The decay of SO_2 is also expressed in terms of the SO_2 half-life or the time required to reduce the amount of SO_2 initially contained in a plume by 50 percent. If the decay rate λ is in units of percent per hour, the SO_2 half-life is equal to $(100 \ell n 2)/\lambda$ hours.

Measurements of the rate at which SO_2 is transformed to sulfates in plumes from coal-fired power plants show an extremely wide range of values depending principally on the time of day, season of the year, geographical location and level of pollutant concentrations (Sidebottom, 1972; Tesche, et al., 1976; Lusis and Wiebe, 1976; Forest and Newman, 1976; Wilson, et al., 1977; Gillani, et al., 1978). From the data presented in the above references, we believe that the values of the decay coefficient λ most likely to apply to the Southwest Pennsylvania AQCR range from 1 to 6 percent per hour with an average value of about 3.5 percent per hour. The SO_2 half-life values corresponding to the above range in λ are 11 to 69 hours with an average value of about 20 hours. An average SO_2 half-life of 20 hours was used for all of the calculations of ground-level SO_2 concentrations in this study. This half-life is consistent with the decay rate used by TRC, Inc. in a study of the impact of SO_2 emissions in Allegheny County, Pennsylvania recently conducted for the Allegheny County Bureau of Air Pollution Control.

Table 4-1 shows the annual average ground-level SO_2 concentrations calculated at selected monitor sites using SO_2 half-life values of 3, 12, 20 and 30 hours. These calculations indicate that a change in the SO_2 half-life from 12 to 30 hours produces a change of about 10 percent in the annual average concentrations. The observed annual average SO_2 concentration for each of the monitoring sites is also given in Table 4-1. With the exception of the Midland monitor site, the observed concentrations tend to support the use of a relatively long SO_2 half-life.

TABLE 4-1

THE EFFECTS OF SO_2 HALF-LIFE ON THE CALCULATED ANNUAL-AVERAGE GROUND-LEVEL SO_2 CONCENTRATION AT SELECTED MONITOR LOCATIONS

Monitor Location	SO_2 Concentration ($\mu g/m^3$)				
	SO_2 Half-Life (Hours)				Observed Concentration
	3	12	20	30	
Beaver Falls	24.5	39.5	43.1	45.2	47.2
New Castle	13.1	25.3	29.1	31.4	39.3
Midland	87.4	107.1	112.5	114.2	78.6
Hazelwood	124.2	146.7	149.7	154.6	141.5
Logans Ferry	36.9	53.5	57.5	60.1	73.0
Downtown	48.2	70.5	75.5	78.3	73.0

4.2 ESTIMATES OF SO_2 BACKGROUND CONCENTRATION

The SO_2 background concentration is defined as the concentration contributed by all SO_2 sources not included in the emissions inventory used for the dispersion-model calculations. In this study, many of the difficulties associated with obtaining accurate background estimates were eliminated by the inclusion of the emissions inventory of all SO_2 sources located within the Southwest Pennsylvania Air Quality Control Region with annual emissions of 10 or more tons, as well as the major SO_2 sources in the West Virginia Panhandle and along the eastern border of Ohio. To the best of our knowledge, the emissions inventory used in the model calculations includes all the large SO_2 sources located within 30 kilometers of the three principal grid areas (New Castle, Beaver and Monessen) for which model calculations were made.

The SO_2 sources not included in the emissions inventory, and thus the sources most likely to contribute to the background concentration in the study area, are:

- Emissions from classical area sources located within the study area
- Emissions from major point sources located outside the area included in the emission inventory

The area-source emissions inventory discussed in Section 2 was used with the long-term dispersion model for area sources in Appendix A to calculate the impact of area sources on ambient SO_2 air quality in the Beaver Valley. Emissions from the following specific types of area sources were included in the calculations:

- Vehicle traffic in the Beaver Valley area which was represented by 18 area sources

- Home-heating in the Baden area

- Aircraft operations at the Greater Pittsburgh Airport

- Rail and barge traffic in a 1-kilometer corridor along the Ohio River and extending along the Beaver River to Beaver Falls which was represented by 131 area sources

Figure 4-1 shows the SO_2 concentration isopleths resulting from the long-term area source calculations. The maximum calculated annual average concentration for the combined effects of emissions from home heating, rail traffic and barge traffic is 2.7 micrograms per cubic meter which occurs in Baden near the J & L Aliquippa Plant. Figure 4-2 shows the isopleth pattern of SO_2 concentration calculated for the single home-heating area source in Baden. The dimensions of the Baden area source are 1.6- x 1.6-kilometers and the SO_2 emission rate for home heating is 0.1 grams per second which is equivalent to 1.36 tons of SO_2 per square kilometer per year. The air quality impact of all the above area source emissions calculated for the Beaver Valley by means of the short-term dispersion model for area sources is very similar to that calculated by the corresponding long-term dispersion model. Specifically, the calculated short-term concentration contributions from area sources are approximately equal to the calculated long-term concentration contributions. The only significant difference is a displacement of the isopleth pattern reflecting the specific wind-direction distributions used in the short-term calculations. We conclude that the maximum contribution of area-source emissions to the short-term and annual SO_2 background concentrations is less than 5 micrograms per cubic meter. The results discussed in the following sections of this report do not include any estimates or calculations of the contribution of area sources to the total SO_2 concentrations.

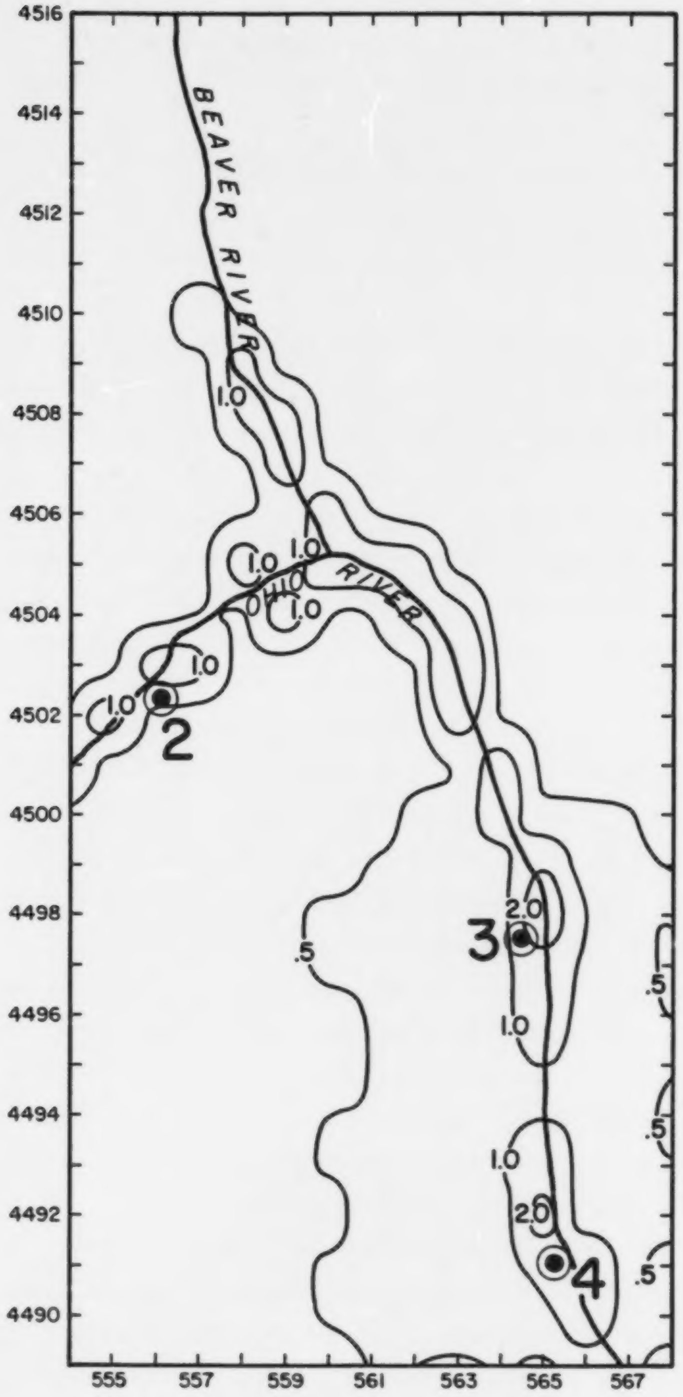

FIGURE 4-1. Isopleths of annual average SO_2 ground-level concentration in micrograms per cubic meter calculated for the Beaver Valley using the long-term area source model. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillip Plants.

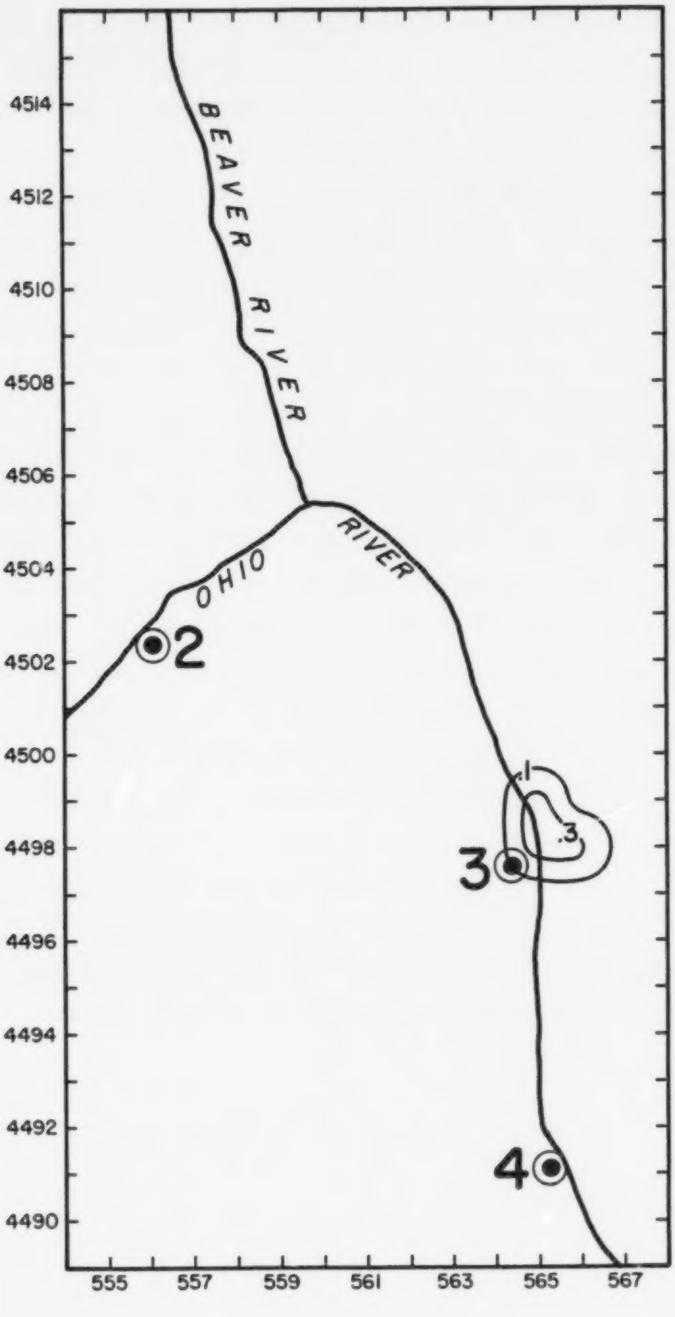

FIGURE 4-2. Isopleths of annual average SO_2 ground-level concentration in micrograms per cubic meter calculated for the single home-heating area source in Baden. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillip Plants.

The potential contribution to the background SO_2 concentration from the atmospheric transport or advection into the study area from major point sources located beyond the area included in the emissions inventory was estimated as follows. According to the results of the annual average concentration calculations described in Section 5 below, the combined contribution of the Ohio and West Virginia sources in the New Castle area, which is approximately 50 kilometers from these sources, is about 15 micrograms per cubic meter. Similarly, the combined contribution of these sources in the Beaver area, which is at a distance of approximately 20 kilometers, is about 27 micrograms per cubic meter. The contribution of the Ohio and West Virginia sources is thus approximately inversely related to the distance from the sources to the receptors or grid points. If we assume that a similar number of other major SO_2 sources are located at a distance of 50 to 100 kilometers, it follows that the maximum contribution of these sources to the annual average background concentration in the study area would be about 10 micrograms per cubic meter. However, the number of major SO_2 sources not included in the emissions inventory used in this study which are located within 100 kilometers of the New Castle and Beaver areas is very small. Therefore, we believe that the annual average SO_2 background concentration contributed by distant major SO_2 sources not included in the inventory is insiginificant compared to the contributions of the sources contained in the inventory. The same reasoning leads to the conclusion that the short-term background concentration from distant sources not included in the emissions inventory is also insignificant.

SECTION 5

LONG-TERM CALCULATIONS

5.1 CALCULATION PROCEDURES

Figure 5-1 is a map of the Southwest Pennsylvania AQCR and adjacent areas in Ohio and West Virignia showing the locations of the various calculation grids as well as the large SO_2 sources and source complexes used in the long-term model calculations. The SO_2 monitor sites used in the long-term model validation calculations are also shown. The dashed lines in the figures define the limits of the gross calculation grid used in the early part of the study to determine the areas within the Beaver Valley and Monongahela Valley Air Basins in which high ground-level SO_2 concentrations would most likely occur. The overall dimensions of the gross calculation grid are 100 x 140 kilometers. A regular 5-kilometer spacing between grid points was used within a central 60 x 100 kilometer section of the gross grid which included most of the major SO_2 sources in the Southwest Pennsylvania AQCR. A 10-kilometer spacing of grid points was used in the portion of the gross grid outside this central section.

The five shaded areas in Figure 5-1 were selected for detailed dispersion-model calculations with a 1-kilometer spacing of grid points, using the annual 1980 compliance emissions inventory. The selection of the five smaller calculation grids was based on the results of model calculations made with the LONGZ computer program using the annual 1980 compliance emissions inventory in Appendix C.1 with the meteorological inputs in Appendix B.1 developed from the 1965 hourly observations made at the Greater Pittsburgh Airport. The Beaver calculation grid (Number 1 in Figure 5-1) measures 17 x 27 kilometers and is approximately centered on the confluence of the Beaver and Ohio Rivers. The New Castle calculation grid (Number 2 in Figure 5-1) measures 7 x 10 kilometers and encloses

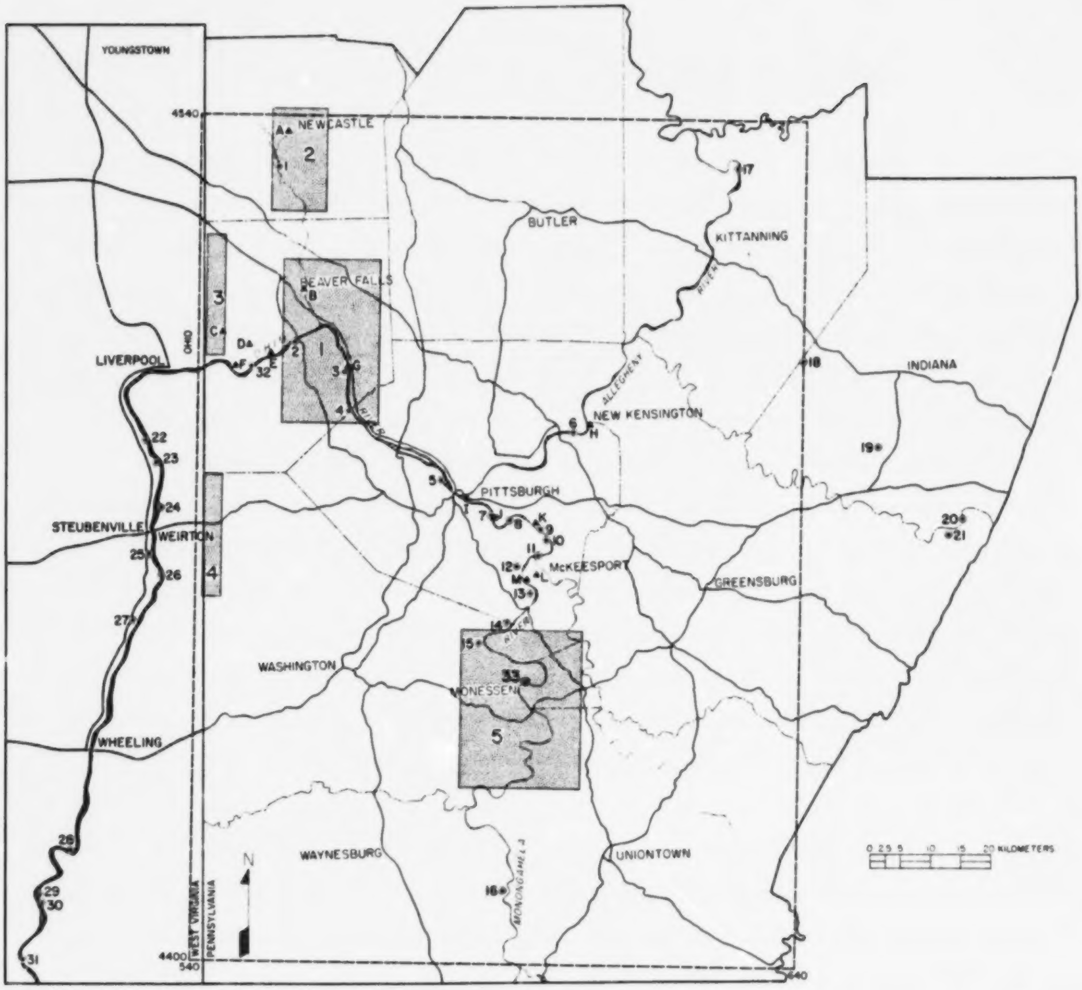

FIGURE 5-1. Map of the Southwest Pennsylvania AQCR and surrounding area. Dashed lines show the gross grid and shaded areas show the five smaller grids used for dispersion-model calculations. Major SO_2 sources and source complexes are indicated by the numbers 1 through 33 and SO_2 monitor locations used for model validation are indicated by the letters A through M.

the heavily populated area around the city of New Castle. The two western border calculation grids (Number 3 and Number 4 in Figure 5-1) are each 4 x 17 kilometers and are located along sections of the border of the Southwest Pennsylvania AQCR likely to be heavily impacted by the large SO_2 sources across the border in eastern Ohio and in West Virginia. The Monessen calculation grid (Number 5 in Figure 5-1) measures 21 x 27 kilometers and is approximately centered on the Monengahela River Valley near Charleroi. The major SO_2 sources and the SO_2 monitor locations in Figure 5-1 are identified in Tables 5-1 and 5-2.

The meteorological inputs for the long-term calculations of ground-level SO_2 concentrations were developed from observations made at the Greater Pittsburgh Airport (See Section 3). We used annual and seasonal statistical summaries of the wind speed and direction observations for the years 1964 and 1973 through 1977 in an attempt to define a worst-case year (i.e., a year in which the meteorology would lead to the highest calculated annual average SO_2 concentrations). As might be expected, the definition of a worst-case year is very complicated because the calculated maximum SO_2 ground-level concentrations are critically dependent on both the source-receptor geometry and the meteorology. Consequently, the worst-case meteorology varies with receptor location. Because of these difficulties, we decided to use 1965 as the worst-case meteorological year on the basis of a study by Rubin (1974). In this study, Rubin defined 1965 as the worst-case meteorological year for SO_2 concentrations in Allegheny County from the results of annual SO_2 model calculations made using a fixed set of point-source emissions data for Allegheny County with various sets of meteorological inputs developed from the annual wind distributions for the Greater Pittsburgh Airport.

The annual 1980 compliance emissions Inventory given in Appendix C.1 was used with the LONGZ computer program containing the long-term dispersion model described in Appendix A to calculate annual ground-level SO_2 concentrations in the five grid areas shown in Figure 5-1. The results of these calculations are described below and in Section 8.

TABLE 5-1

LIST OF MAJOR SO_2 SOURCES IN FIGURE 5-1

Source Number	Source Name	UTM Coordinates (m)	
		X	Y
1	Penn Power, West Pittsburgh	553,105	4,531,767
2	St. Joe Minerals	556,065	4,502,301
3	J & L Aliquippa	564,400	4,497,500
4	Duquesne Light, Phillips	565,260	4,491,020
5	Duquesne Light, Brunot Is.	580,680	4,479,680
6	Duquesne Light, Cheswick	602,330	4,487,800
7	J & L Pittsburgh	589,000	4,473,900
8	USS Homestead	592,100	4,473,100
9	USS Edgar Thomson	597,260	4,471,685
10	USS Duquesne	598,324	4,470,025
11	USS National	597,000	4,467,500
12	USS Irvin	593,180	4,465,700
13	USS Clairton	595,500	4,461,500
14	Duquesne Light, Elrama	592,000	4,456,200
15	Penn Power, Mitchell	587,340	4,452,810
16	Hatfield Power	591,570	4,412,040
17	Armstrong Power	628,979	4,531,996
18	Keystone Power	640,141	4,502,155
19	Homer City Power	652,756	4,486,147
20	Seward Power	666,882	4,474,602
21	Conemaugh Power	664,582	4,471,929
22	Ohio Ediwon, Sammis	531,700	4,485,500
23	Ohio Power, Toronto	533,500	4,481,800
24	National Steel, Wierton Div.	534,300	4,474,400
25	Wheeling-Pittsburgh (North)	532,500	4,466,700
26	Wheeling-Pittsburgh (South)	534,600	4,463,300
27	Cardinal Power	530,000	4,455,800
28	Ohio Edison, Burger	520,500	4,417,500
29	Kammer Power	515,320	4,410,320
30	Mitchell Power	515,800	4,408,670
31	PPG	512,600	4,399,600
32	Penn Power, Mansfield	549,049	4,498,067
33	Wheeling-Pittsburgh, Monessen	594,170	4,446,350

TABLE 5-2

LIST OF SO_2 MONITOR SITES IN FIGURE 5-1

Site Symbol	Site Name (Operator)	UTM Coordinates (m)		Site Elevation (m MSL)
		X	Y	
A	New Castle (DER)	554,830	4,537,240	257
B	Beaver Falls (DER)	557,750	4,510,785	220
C	Fairview (Penn Power)	544,820	4,504,390	390
D	Route 68 (Penn Power)	550,720	4,500,640	238
E	West Beaver (Penn Power)	548,950	4,502,000	375
F	Midland (DER)	546,330	4,498,340	249
G	Baden (DER)	565,090	4,498,380	230
H	Logans Ferry (BAPC)	605,154	4,489,115	268
I	Downtown (BAPC)	585,150	4,476,600	256
J	Hazelwood (BAPC)	589,762	4,473,952	284
K	North Braddock (BAPC)	596,680	4,472,835	275
L	Liberty Boro (BAPC)	596,210	4,464,150	340
M	Glassport (BAPC)	594,190	4,463,580	234

5.2 LONG-TERM CALCULATION RESULTS

The maximum annual average SO_2 concentration calculated for the Beaver grid of 76.8 micrograms per cubic meter occurs at a grid point on the western boundary of the Beaver grid with UTM X and Y coordinates of 554 and 4,503 kilometers respectively. As shown in Figure 5-2, which presents the annual average SO_2 isopleth pattern calculated for the Beaver grid, this maximum is located approximately 2.5 kilometers west-northwest of the St. Joe Minerals Plant, which is indicated by the number 2 in the figure. Additional calculations made at grid points located 1 kilometer southwest, west and northwest of the point of maximum concentration on the western boundary show annual average SO_2 concentrations which are less than the maximum calculated on the boundary.

The contributions of individual sources and source complexes in the 1980 compliance emissions inventory to the maximum annual average concentration calculated for the Beaver grid are given in Table 5-3. Sources in the Beaver Valley contributed 38.5 micrograms per cubic meter or about 50 percent of the calculated maximum concentration. Of the 38.5 micrograms per cubic meter contributed by the Beaver Valley sources, 27.7 micrograms per cubic is contributed by St. Joe Minerals. The combined Eastern Ohio and West Virginia sources contribute 26.7 micrograms per cubic meter or about 35 percent of the total maximum annual average SO_2 concentration calculated for the Beaver grid. Sources located in Allegheny County contribute 7.2 micrograms per cubic meter, other Pennsylvania sources contribute 3.8 micrograms per cubic meter and sources located in the Monongahela River Valley contribute 0.6 micrograms per cubic meter. These source contributions account for the remaining 15 percent of the total calculated maximum concentration. Additional calculations were made using a 100-meter spacing of the grid points within the small Baden grid shown in Figure 5-2. The maximum concentration shown by these calculations of 72.2 micrograms per cubic meter occurs at the grid point located east of the J & L Aliquippa Plant with UTM X and Y coordinates of 565.6 and 4,497.8 kilometers, respectively.

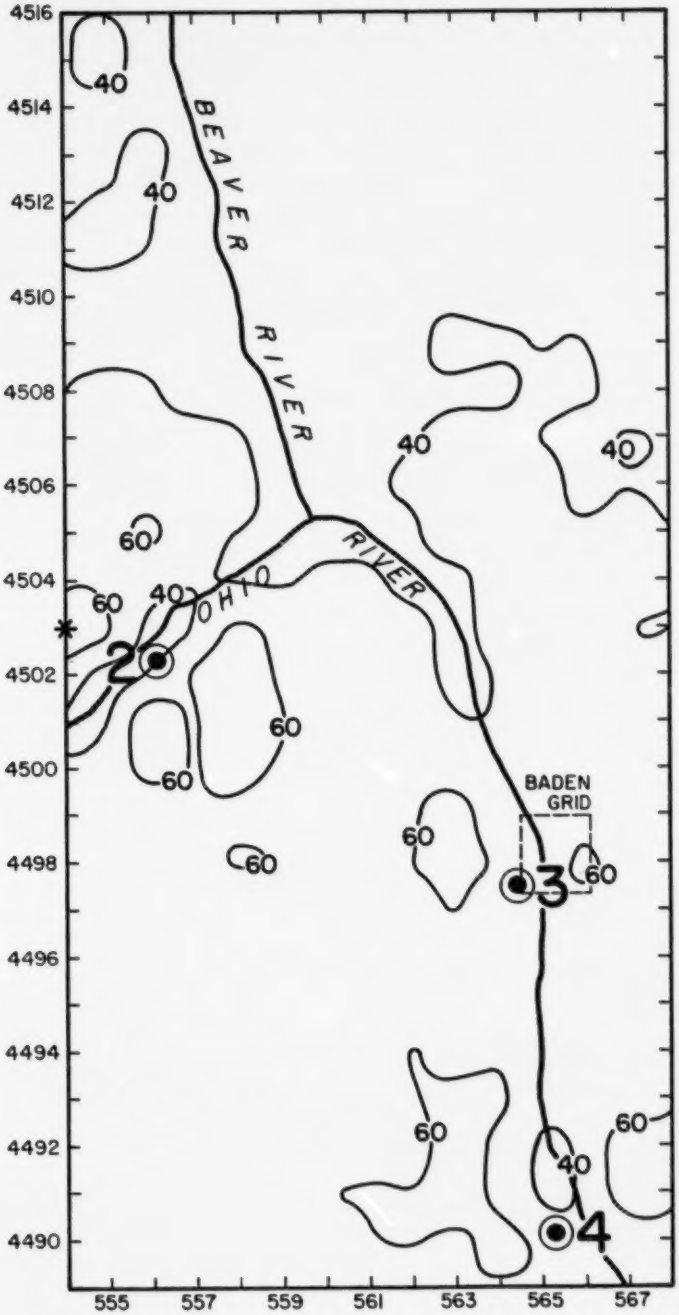

FIGURE 5-2. Isopleths of annual ground-level SO_2 concentration in $\mu g/m^3$ calculated for the Beaver grid using the 1980 compliance emissions inventory. The numbers 2, 3 and 4 respectively show the locations of the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillips Sources. The asterisk symbol incicates the point of maximum concentration and the dashed lines show the small Baden calculation grid.

TABLE 5-3

CONTRIBUTIONS OF INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM ANNUAL AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE BEAVER GRID USING THE 1980 COMPLIANCE EMISSIONS INVENTORY

Source	Annual Average SO_2 Concentration* ($\mu g/m^3$)
Beaver Valley Sources	
J & L Aliquipa	1.5
Medusa Cement	0.1
ARCO	4.7
B & W Wallace Run	0.1
B & W Tubular Products	0.1
Shenango China	**
Ashland Oil	0.1
Westinghouse Electric	**
Penn Power, West Pittsburgh	0.3
Penn Power, Mansfield	4.1
St. Joe Minerals	27.4
Bessemer Cement	0.1
Total	38.5
Allegheny County Sources	7.2
Monongahela Valley Sources	0.6
Other Pennsylvania Sources	3.8
Eastern Ohio Sources	16.7
West Virginia Sources	10.0
Total	76.8

* Occurs at a grid point with the UTM coordinates X=554 kilometers and and Y=4,503 kilometers.

** Less than 0.05 $\mu g/m^3$.

Figure 5-3 shows the annual average SO_2 isopleth pattern calculated for the New Castle grid using the 1980 compliance emissions inventory. The calculated maximum annual average SO_2 concentration resulting from the emissions of all sources combined is 37.3 micrograms per cubic meter and occurs at a point near the southern boundary of the New Castle Grid with the UTM X and Y coordinates of 558 and 4,525 kilometers, respectively. Contributions of the individual sources and source complexes to the maximum annual average SO_2 concentration calculated for the New Castle grid are given in Table 5-4. The calculated contribution of the Beaver Valley sources to the maximum concentration is 14.0 micrograms per cubic meter or about 38 percent of the total. Of the 14.0 micrograms per cubic meter contributed by the Beaver Valley sources, the Medusa Cement Plant contributed 9.3 micrograms per cubic meter. The combined sources in Eastern Ohio and West Virginia contributed 14.4 micrograms per cubic meter to the maximum or about 39 percent of the total.

The contribution of the Penn Power, West Pittsburgh Plant to the annual average SO_2 concentrations in the New Castle area was calculated by using an operating level of 75 percent of capacity and a GEP (Good Engineering Practive) stack height of 145 meters in place of the actual stack height of 229 meters. The maximum annual average SO_2 concentration produced by the West Pittsburgh Plant occurs at a grid point with the UTM X and Y coordinates of 556 and 4,532 kilometers, respectively. The calculated total annual average SO_2 concentration at this point produced by all sources combined is 31.2 micrograms per cubic meter. Of this, 5.8 micrograms per cubic meter or 18.6 percent is contributed by the West Pittsburgh Plant emissions; 4.4 micrograms per cubic meter or 14.1 percent, is contributed by the sources in the Beaver Valley; 7.7 micrograms per cubic meter or 24.7 percent is due to the eastern Ohio sources; 5.2 micrograms per cubic meter or 16.7 percent is contributed by the West Virginia sources; 4.2 micrograms per cubic meter or 13.5 percent is due to the other Pennsylvania sources; and 3.5 micrograms per cubic meter or 11.2 percent is contributed by sources located in Allegheny County. Additional concentration calculations

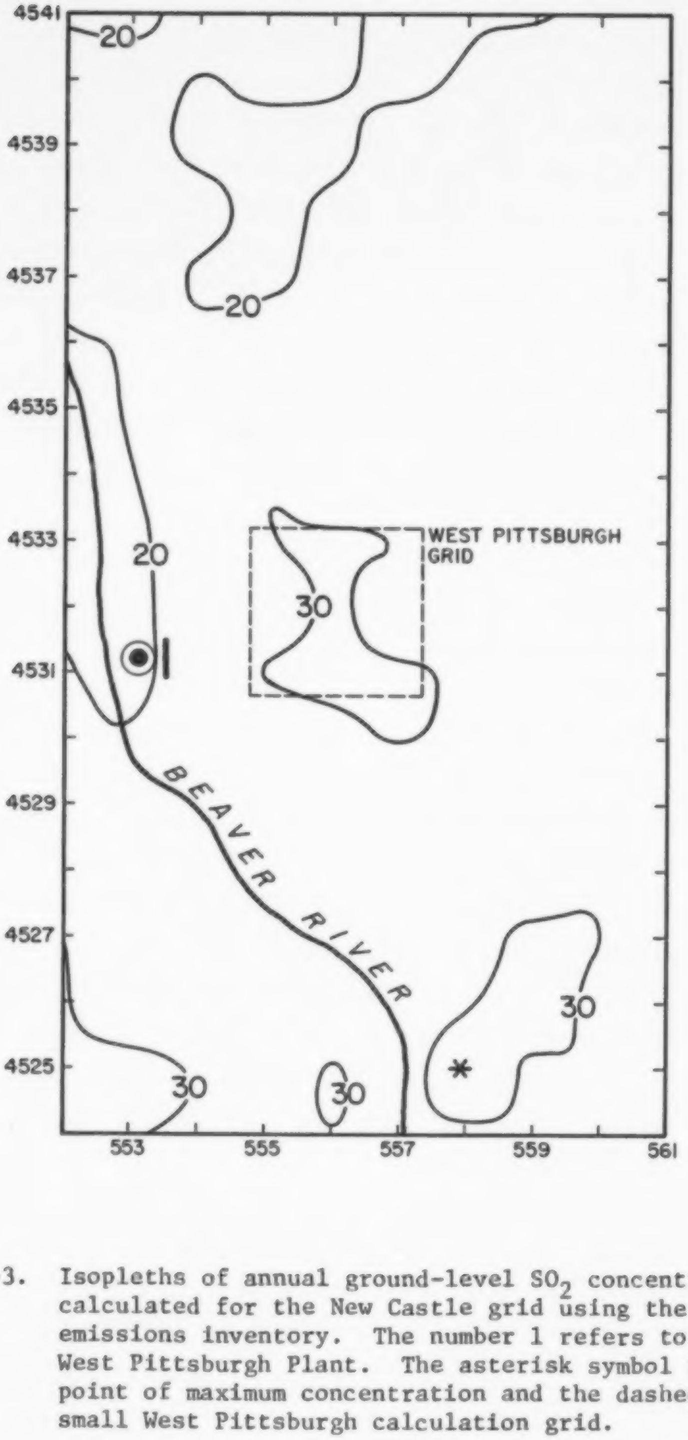

FIGURE 5-3. Isopleths of annual ground-level SO_2 concentration in μg/m^3 calculated for the New Castle grid using the 1980 compliance emissions inventory. The number 1 refers to the Penn Power, West Pittsburgh Plant. The asterisk symbol indicates the point of maximum concentration and the dashed lines show the small West Pittsburgh calculation grid.

TABLE 5-4

CONTRIBUTIONS OF INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM ANNUAL AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE NEW CASTLE GRID USING THE 1980 COMPLIANCE EMISSIONS INVENTORY

Source	Annual Average SO_2 Concentration* ($\mu g/m^3$)
Beaver Valley Sources	
J & L Aliquipa	0.6
Medusa Cement	9.3
ARCO	0.3
B & W Wallace Run	0.1
B & W Tubular Products	0.1
Shenango China	**
Ashland Oil	0.1
Westinghouse Electric	**
Penn Power, West Pittsburgh	0.9
Penn Power,	0.6
St. Joe Minerals	1.7
Bessemer Cement	0.3
Total	14.0
Allegheny County Sources	4.3
Monongahela Valley Sources	0.3
Other Pennsylvania Sources	4.3
Eastern Ohio Sources	8.8
West Virginia Sources	5.6
Total	37.3

* Occurs at a grid point with the UTM coordinates X=558 kilometers and Y=4,525 kilometers.

** Less than 0.05 $\mu g/m^3$.

were also made at grid points spaced at 250 meters within the small West Pittsburgh grid shown in Figure 5-3. The location and magnitude of the maximum concentration were unchanged from the values given above.

The maximum annual average SO_2 concentration calculated for the Monessen grid is 86.2 micrograms per cubic meter at a grid point with the UTM X and Y coordinates of 594 and 4,447 kilometers, respectively. This point which is located approximately 1 kilometer north of the Wheeling Pittsburgh Steel Plant at Monessen, is an isolated point of high concentration with the calculated concentrations at the surrounding grid points ranging from 40.0 to 61.5 micrograms per cubic meter. Figure 5-4 shows the annual average SO_2 isopleth pattern calculated for the Monessen grid. The contributions from individual sources and source complexes to the maximum annual average concentration calculated for the Monessen grid are given in Table 5-5. Sources in the Monongahela Valley contribute 53.6 micrograms per cubic meter or approximately 62 percent of the maximum. Allegheny County sources contribute 6.4 micrograms per cubic meter (7.6%). Other Pennsylvania sources contribute 9.0 micrograms per cubic meter (10.4%). Ohio sources 9.9 micrograms per cubic meter (11.5%) and West Virginia Sources contribute 7.1 micrograms per cubic meter (8.2%). Additional concentration calculations were made using a grid spacing of 500 meters within the detail Monessen grid shown in Figure 5-4. The location and magnitude of the maximum concentration were unchanged for the values given above.

The results of the long-term model calculations for the two western border grids are presented in Section 8.1.

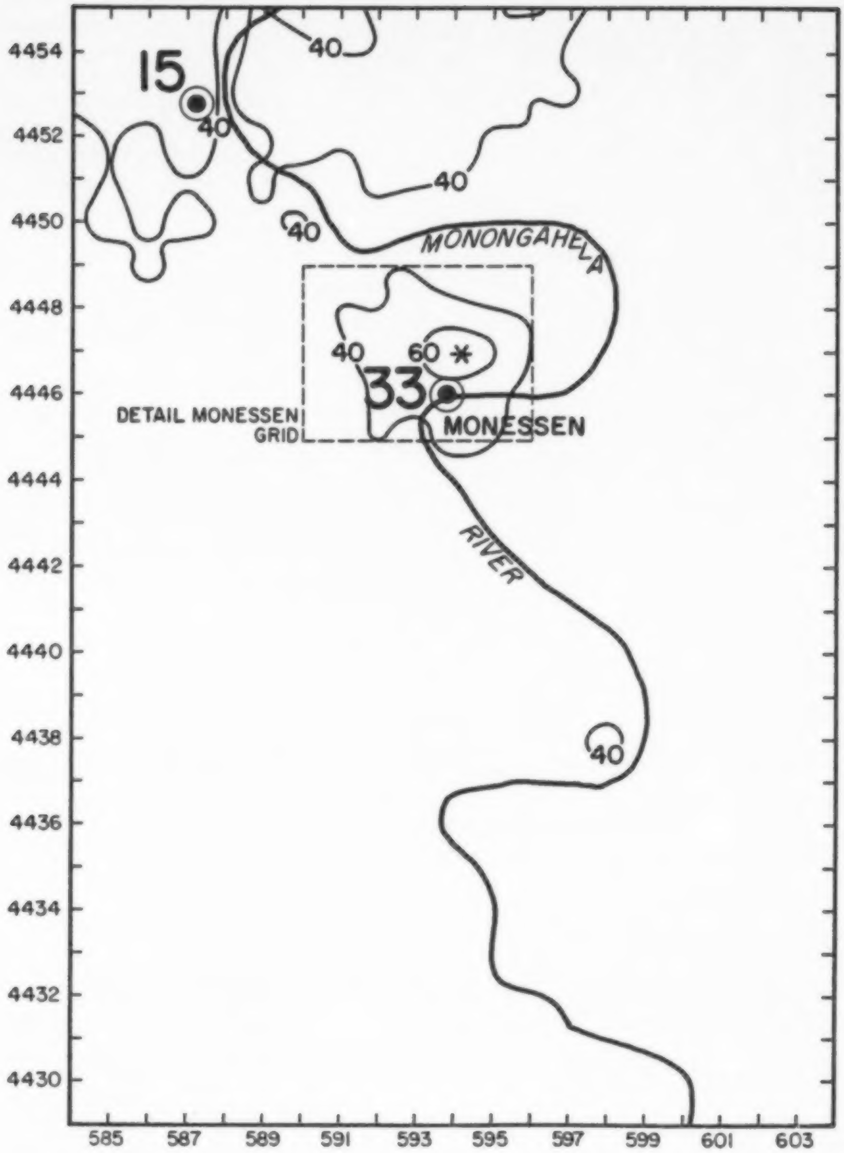

FIGURE 5-4. Isopleths of annual ground-level SO_2 concentrations in $\mu g/m^3$ calculated for the Monessen grid using the 1980 compliance emissions inventory. The number 15 identifies the Penn Power, Mitchell Plant and number 33 identifies the Wheeling-Pittsburgh, Monessen Plant. The asterisk symbol indicates the point of maximum concentration and the dashed lines show the detail Monessen calculation grid.

TABLE 5-5

CONTRIBUTIONS OF INDIVIDUAL SOURCES AND SOURCE COMPLES TO THE MAXIMUM ANNUAL AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE MONESSEN GRID USING THE 1980 COMPLIANCE EMISSIONS INVENTORY

Source	Annual Average SO_2 Concentration* ($\mu g/m^3$)
Monongahela Valley Sources	
ARMCO	**
Mitchell	1.0
Elrama	1.9
Wheeling Pittsburgh, Monessen	50.3
Wheeling Pittsburgh, Allenport	0.2
Allied Chemical	0.2
Total	53.8
Allegheny County Sources	6.4
Beaver Valley Sources	0.8
Other Pennsylvania Sources	8.2
Eastern Ohio Sources	9.9
West Virginia Sources	7.1
Total	86.2

* Occurs at a grid point with the UTM coordinates X=594 kilometers and Y=4,747 kilometers.

** Less than 0.05 $\mu g/m^3$.

SECTION 6

SHORT-TERM MODEL CALCULATIONS

6.1 CALCULATION PROCEDURES

The short-term 1980 compliance emissions inventory given in Appendix C.2 was used with the SHORTZ computer program containing the short-term dispersion model described in Appendix A and worst-case 3-hour and 24-hour meteorological inputs, developed from hourly meteorological observations made at the Greater Pittsburgh Airport, to calculate short-term concentrations within the five calculation grids described in Section 5.1. In addition to the regular 1-kilometer grid point spacing, a 200-meter spacing was used for the New Castle grid in a small area around the Penn Power, West Pittsburgh Plant and a 500-meter spacing was used for the Monessen grid in a small area of high terrain north of the Monessen Plant of Wheeling-Pittsburgh Steel. The locations of high terrain elevations and SO_2 monitor sites were also included as discrete points in the short-term calculations. To reduce the number of requisite computer calculations, portions of the calculation grids which the meteorological observations indicated would be clearly unaffected by the transport and dispersion of relevant source emissions were excluded from the executions of the SHORTZ computer program.

The following rationale was used in selecting the meteorological conditions most likely to cause the highest short-term ground-level concentrations in the New Castle, Beaver and Western Border calculation grids. As shown in Figure 5-1, there are a very large number of major SO_2 sources located in the Ohio River Valley to the west and south-southwest of these calculation grids. According to short-term 1980 compliance emissions inventory in Appendix C.2, approximately 51 percent of the total emissions for all SO_2 sources combined is from sources located in Ohio and West Virginia. Emissions from sources located in the Beaver Valley account for about 4 percent of the total emissions from all sources; emissions from sources in Allegheny County and the Monongahela River Valley account for about 9 percent of the total emissions and the remaining 36 percent of the total emissions are contributed by other Pennsylvania sources. We analyzed the hourly surface observations from the Greater Pittsburgh Airport for the five-year period from 1973 through 1977, using the PRSIST computer program, to determine the occurrence frequency and time duration of persistent wind directions required to transport emissions from the sources in Ohio, West Virginia, Allegheny County and the Monongahela River Valley to the New Castle and Beaver calculation grids. The results of the PRSIST analysis showed that there were a number of cases during the five-year period of record of 24-hour or longer persistence of wind directions within the 60-degree angular sector from 180 to 240 degrees. These are the wind directions required to transport emissions from the major SO_2 sources in Ohio and West Virginia to the New Castle and Beaver calculation grids, as well as the two Western Border grids shown in Figure 5-1. On the other hand, the PRSIST analysis revealed that wind directions within the sector required to transport emissions from sources located in Allegheny County and the Monongahela River Valley to the New Castle and Beaver calculation grids persisted for only a few hours. We therefore concluded from the results of the PRSIST analysis that the worst-case short-term meteorological conditions for the New Castle, Beaver and Western Border calculation grids were most likely to occur with persistent wind directions from the south-southwest and southwest. Model calculations were made using the short-term 1980 compliance emissions inventory with the SHORTZ computer program and the Greater Pittsburgh Airport hourly meteorological observations and mixing heights for the cases of maximum persistence of these wind directions obtained from the PRSIST analysis. These calculations showed maximum hourly plume-centerline concentrations of approximately 800 micrograms per cubic meter at the western edge of the New Castle grid when the mixing heights were between 190 and 250 meters. However, according to the results of the PRSIST analysis, these mixing heights did not persist in any case for as long as 10 hours, which is the minimum time duration required to yield calculated 24-hour average concentrations equal to or greater than 24-hour SO_2 NAAQS. The maximum hourly plume-centerline concentrations calculated for the western border of the Beaver grid for the selected wind-persistence cases were approximately 1000 micrograms per cubic meter under the same meteorological conditions as those specified for the New Castle grid.

Because of the relatively long transport distances (30 to 60 kilometers) from some of the sources in Ohio and West Virginia to the New Castle and Beaver calculation grids as well as possible terrain channeling and trapping effects, we reviewed the assumption made in the model calculations that meteorological observations made at the Greater Pittsburgh Airport could be used to estimate plume trajectories, wind speeds and mixing heights over these distances. Terrain elevations in the Ohio River Valley are approximately 200 meters (650 feet) above mean sea level (MSL). The average elevation of the high terrain at the sides of the valley and beyond is about 300 meters (1000 feet) MSL with a few isolated points that are 400 meters (1300 feet) MSL. The stack heights associated with the major SO_2 sources located in the Ohio River Valley are generally greater than 150 meters. Assuming that the plume rise is approximately equivalent to the stack height, the plume stabilization heights are thus about 500 meters MSL which is well above the highest terrain elevations. Therefore, we conclude it is unlikely that the plumes would be trapped within the river valley during periods with an established wind flow with minimum speeds of a few meters per second. Under these conditions, the plumes would be well above the local terrain features and would thus not be subject either to terrain channeling or trapping. Emissions from low-level sources will generally be channeled by the terrain when the mixing heights are at or below the terrain heights. When the mixing heights exceed the terrain heights, these emissions will be transported in the same general direction as the tall stack emissions.

There is a question whether the hourly Greater Pittsburgh Airport meteorological observations are representative of the concurrent meteorological conditions in the Ohio River Valley and in the western part of the Southwest Pennsylvania AQCR. It has been our experience that the measurements at the Greater Pittsburgh Airport are most likely to be representative of the meteorological conditions over this area when the measured hourly wind directions persist within a 30- or 60-degree sector for periods of 6 hours or longer. These persistent wind directions occur only when the large scale circulation pattern is well established with mean surface speeds greater than 3 meters per second. Using the results of the PRSIST analysis of the 1973-1977 Greater Pittsburgh Airport meteorological data in combination with dispersion-model calculations, we selected 28 August 1976 as the case most likely to produce maximum short-term SO_2 concentrations in the New Castle and Beaver areas. Table 6-1 lists the hourly meteorological input parameters used with short-term dispersion model computer program SHORTZ to calculate SO_2 ground-level concentrations in the New Castle and Beaver grids produced by the short-term 1980 compliance emissions inventory (see Appendix C.2). In these calculations, we assumed an SO_2 half-life of 20 hours (see Section 4.1).

We performed dispersion-model calculations using the gross grid and the hourly meteorological observations from the Greater Pittsburgh Airport for 6 April 1975 and 16 August 1976 when persistent winds were observed from the north and west, respectively. The purpose of these calculations was to determine if these wind directions were likely to result in maximum short-term concentrations that exceeded those calculated for 28 August 1976. The calculated maximum concentrations for both of the cases were significantly lower than those calculated for 28 August 1976.

6.2 SHORT-TERM CALCULATION RESULTS

Figure 6-1 shows the calculated 24-hour average SO_2 isopleth pattern for the Beaver grid. The maximum 24-hour average SO_2 concentration

TABLE 6-1

HOURLY METEOROLOGICAL INPUT PARAMETERS USED IN THE SHORT-TERM MODEL CALCULATIONS FOR 28 AUGUST 1976

Hour (LST)	Wind Direction (deg)	Wind Speed (m/sec)	H_m (m)	T_a (^oK)	$\Delta\theta/\Delta Z$ ($^oK/m$)	P	σ'_E (rad)	σ'_A (rad)	Pasquill Stability Category
00	201	2.57	340	292	.006	.13	.0465	.0665	E
01	231	2.57	340	292	.006	.13	.0465	.0665	E
02	223	2.06	340	292	.006	.13	.0465	.0665	E
03	171	1.54	340	290	.006	.13	.0465	.0665	E
04	157	2.06	340	290	.006	.13	.0735	.1051	D
05	237	2.57	340	291	.006	.13	.0735	.1051	D
06	225	3.09	340	291	.006	.13	.0735	.1051	D
07	224	2.57	405	291	.005	.13	.0735	.1051	D
09	197	2.57	470	293	.005	.13	.0735	.1051	D
09	173	2.57	535	294	.004	.13	.0735	.1051	D
10	205	3.6	600	295	.004	.13	.0735	.1051	D
11	174	4.12	665	295	.003	.13	.0735	.1051	D
12	196	4.63	730	297	.002	.13	.0735	.1051	D
13	226	6.68	795	298	.002	.13	.0735	.1051	D
14	208	6.17	860	299	.001	.13	.0735	.1051	D
15	234	5.14	860	299	.001	.13	.0735	.1051	D
16	224	5.66	807	298	.001	.13	.0735	.1051	D
17	190	4.12	754	296	.001	.13	.0735	.1051	D
18	218	5.14	700	296	.001	.13	.0735	.1051	D
19	232	4.63	700	295	.001	.13	.0735	.1051	D
20	213	4.12	700	294	.001	.13	.0735	.1051	D
21	214	4.12	700	294	.001	.13	.0735	.1051	D
22	271	3.60	700	294	.001	.13	.0735	.1051	D
23	305	3.60	700	294	.001	.13	.0735	.1051	D

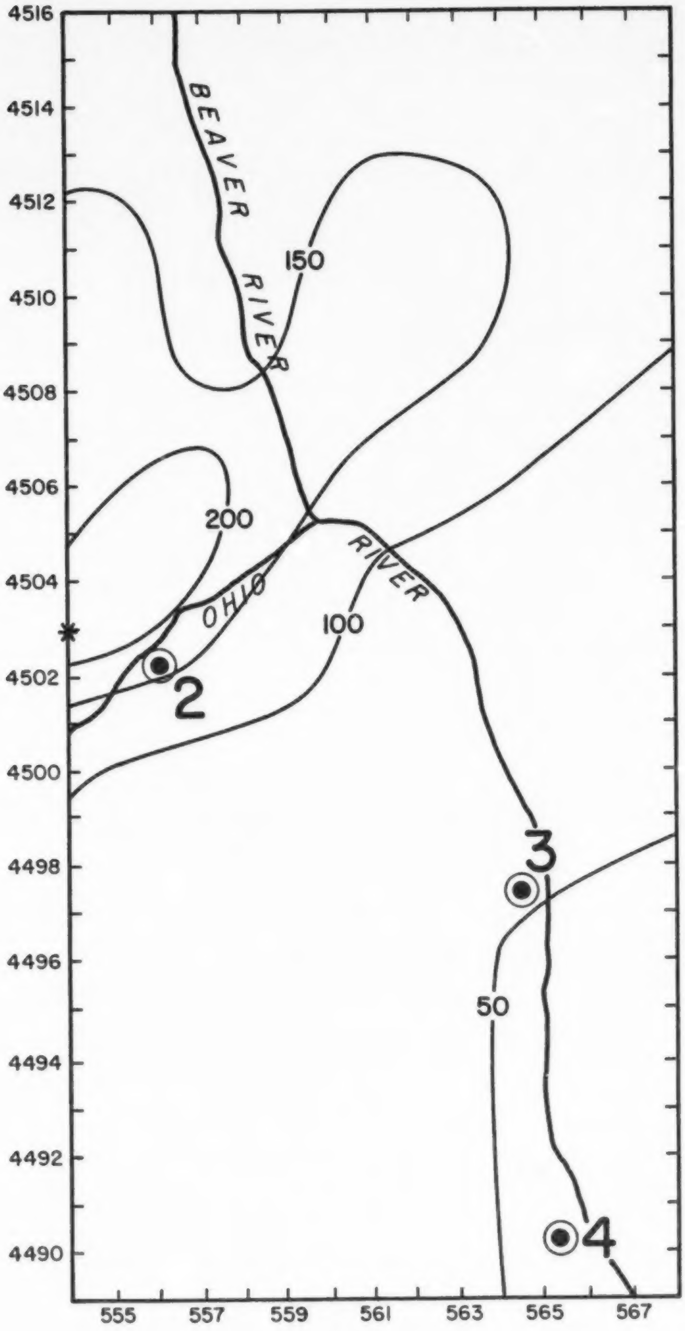

FIGURE 6-1. Isopleths of 24-hour average SO_2 ground-level concentrations in $\mu g/m^3$ calculated for the Beaver grid using the short-term 1980 Compliance Emissions Inventory. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne, Phillips sources. The asterisk symbol indicates the point of maximum concentration.

calculated for the Beaver grid, using the 1980 short-term compliance emissions inventory, is 251.6 micrograms per cubic meter, which is approximately 70 percent of the 24-hour NAAQS of 365 micrograms per cubic meter. This maximum occurs at the grid point on the western edge of the Beaver grid with the UTM X and Y coordinates of 554 and 4,503 kilometers, respectively.

The contributions of individual sources and source complexes to the maximum concentration calculated on the Beaver grid are given in Table 6-2. The sources in the Beaver Valley contributed 104 micrograms per cubic meter or about 41 percent of the calculated maximum concentration. Of the 104 micrograms per cubic meter contributed by the Beaver Valley sources, 89 micrograms per cubic meter are due to the Penn Power, Mansfield Plant and 15 micrograms per cubic meter are due to the ARCO Plant. The Ohio sources and the West Virginia sources respectively contributed 127.5 and 20.1 micrograms per cubic meter (51 and 8 percent) to the maximum 24-hour average SO_2 concentration calculated for the Beaver grid.

The maximum 3-hour average SO_2 concentration calculated for the Beaver grid, using the short-term 1980 compliance emissions inventory, is 835.5 micrograms per cubic meter, which is 64 percent of the NAAQS of 1300 micrograms per cubic meter. The Beaver Valley sources contributed 289 micrograms per cubic meter or about 35 percent of the calculated maximum concentration. The eastern Ohio sources and the West Virginia sources respectively contributed 468.5 and 78 micrograms per cubic meter (56 and 9 percent) to the calculated maximum 3-hour average concentration which occurred at the same grid point as the calculated maximum 24-hour concentration.

The maximum 24-hour average SO_2 concentration calculated for the New Castle grid, using the short-term 1980 compliance emissions

TABLE 6-2

CONTRIBUTIONS FROM INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM 24-HOUR AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE BEAVER GRID USING THE 1980 SHORT-TERM COMPLIANCE EMISSIONS INVENTORY

Source	24-Hour Average SO_2 Concentration* ($\mu g/m^3$)
Beaver Valley Sources:	
J & L Aliquipa	**
Medusa Cement	**
ARCO	15.0
B & W Wallace Run	**
B & W Tubular Products	**
Shenango China	**
Ashland Oil	**
Westinghouse Electric	**
Penn Power,	89.0
West Pittsburgh	**
Penn Power, Mansfield	
St. Joe Minerals	**
Bessemer Cement	**
Total	104.0
Eastern Ohio Sources	127.5
West Virginia Sources	20.1
Total	251.6

* Occurs at a grid point with the UTM coordinates X=554 kilometers and Y=4,503 kilometers.

** Less than 0.05 micrograms per cubic meter.

inventory, is 115.8 micrograms per cubic meter which is about 32 percent of the NAAQS of 365 micrograms per cubic meter. This occurs at a grid point at the northwest corner of the grid with the UTM X and Y coordinates of 555.0 and 4,533.6 kilometers, respectively.

The contributions of individual sources and source complexes to the maximum concentration calculated on the New Castle grid are given in Table 6-3. The combined sources in West Virginia and eastern Ohio contributed 69.4 micrograms per cubic meter or about 60 percent of the calculated maximum concentration. With respect to the Beaver Valley sources, the Penn Power, West Pittsburgh Plant contributed 46.3 micrograms per cubic meter (approximately 40 percent of the total concentration) and the other Beaver Valley sources contributed less than 0.01 micrograms per cubic meter.

The maximum 3-hour SO_2 concentration calculated for the New Castle grid is 337.4 micrograms per cubic meter which occurs at the same grid point as the calculated maximum 24-hour average concentration. The Penn Power, West Pittsburgh Plant contributed 163.4 micrograms per cubic meter or 48 percent of the total. Sources in Ohio and West Virginia respectively contributed 109.4 and 64.6 micrograms per cubic meter (32 percent and 19 percent). The contributions from all other sources are insignificant.

The meteorological data for 28 August 1976 in Table 6-1 were used with the short-term 1980 compliance emissions inventory in Appendix C.2 and the SHORTZ computer program to calculate 3-hour and 24-hour SO_2 concentrations for the Monessen grid. Because the wind directions on 28 August 1976 were from the south and southwest, the Monessen Plant of Wheeling-Pittsburgh Steel is only major SO_2 source contributing significantly to the ground-level concentrations calculated for the Monessen grid. The calculated maximum 24-hour average SO_2 concentration for the Monessen grid is 226.9 micrograms per cubic meter and the calculated maximum 3-hour average SO_2 concentration is 703.9 micrograms per cubic meter. Both of

TABLE 6-3

CONTRIBUTIONS FROM INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM 24-HOUR AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE NEWCASTLE GRID USING THE SHORT-TERM 1980 COMPLIANCE EMISSION INVENTORY

Source	24-Hour Average SO_2 Concentration* ($\mu g/m^3$)
Penn Power, West Pittsburgh	46.3
Other Beaver Valley Sources	<0.1
West Virginia Sources	23.8
Eastern Ohio Sources	45.6
TOTAL	115.8

* Occurs at a grid point with the UTM coordinates X=555 kilometers and y=4,533.6 kilometers.

these calculated maximums occur at the same grid point which is located on high terrain about 100 meters above plant grade at a distance of about 1.5 kilometers from the plant. The UTM X and Y coordinates of this grid point are 594.4 and Y=4,447.0 kilometers, respectively. Emissions from the Monessen Plant of Wheeling-Pittsburgh Steel contribute all but a few micrograms per cubic meter to the calculated 24-hour maximum concentration and are entirely responsible for the calculated 3-hour maximum. Figures 6-2 and 6-3 show the isopleths of calculated 24-hour and 3-hour SO_2 concentrations for the Monessen grid.

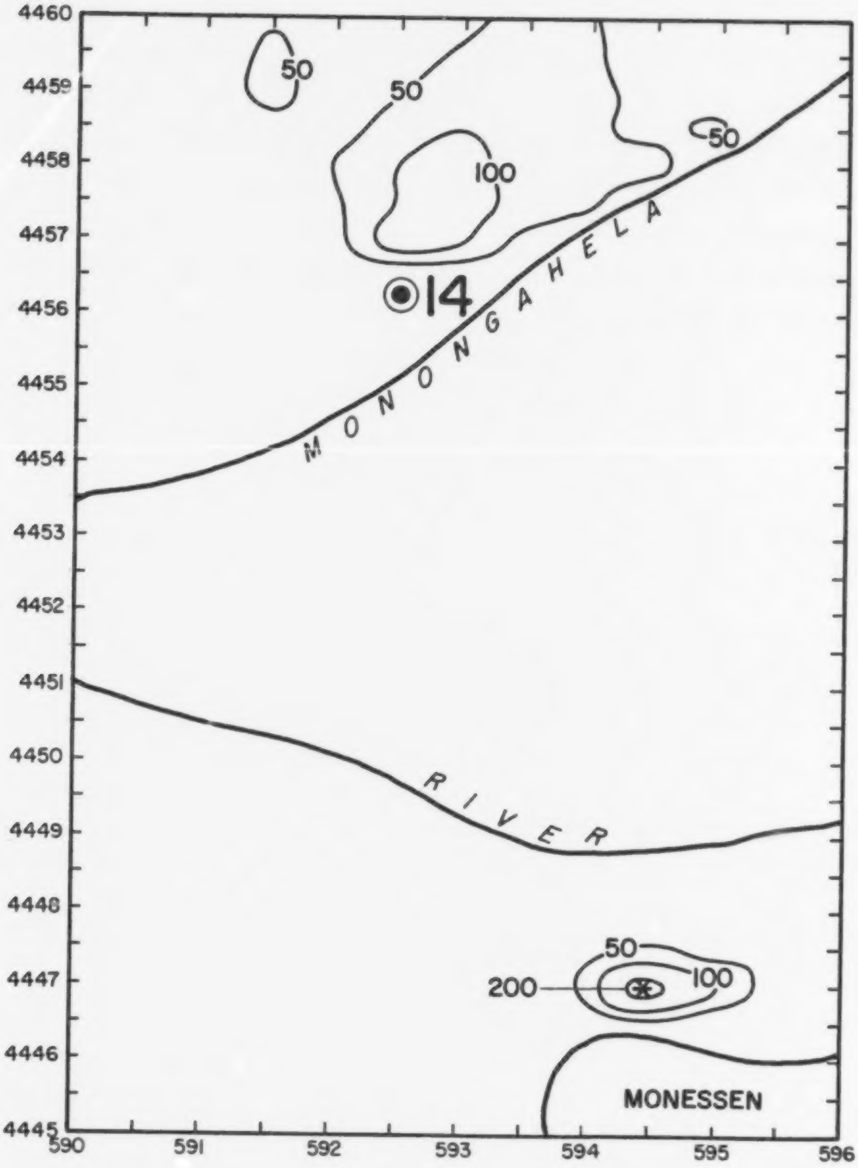

FIGURE 6-2. Isopleths of 24-hour average SO_2 ground-level concentrations in μh/m^3 calculated for the Monessen detail grid using the short-term 1980 compliance emissions inventory. The number 14 refers to the Duquesne Light, Elrama Plant. The asterisk symbol indicates the point of maximum concentration.

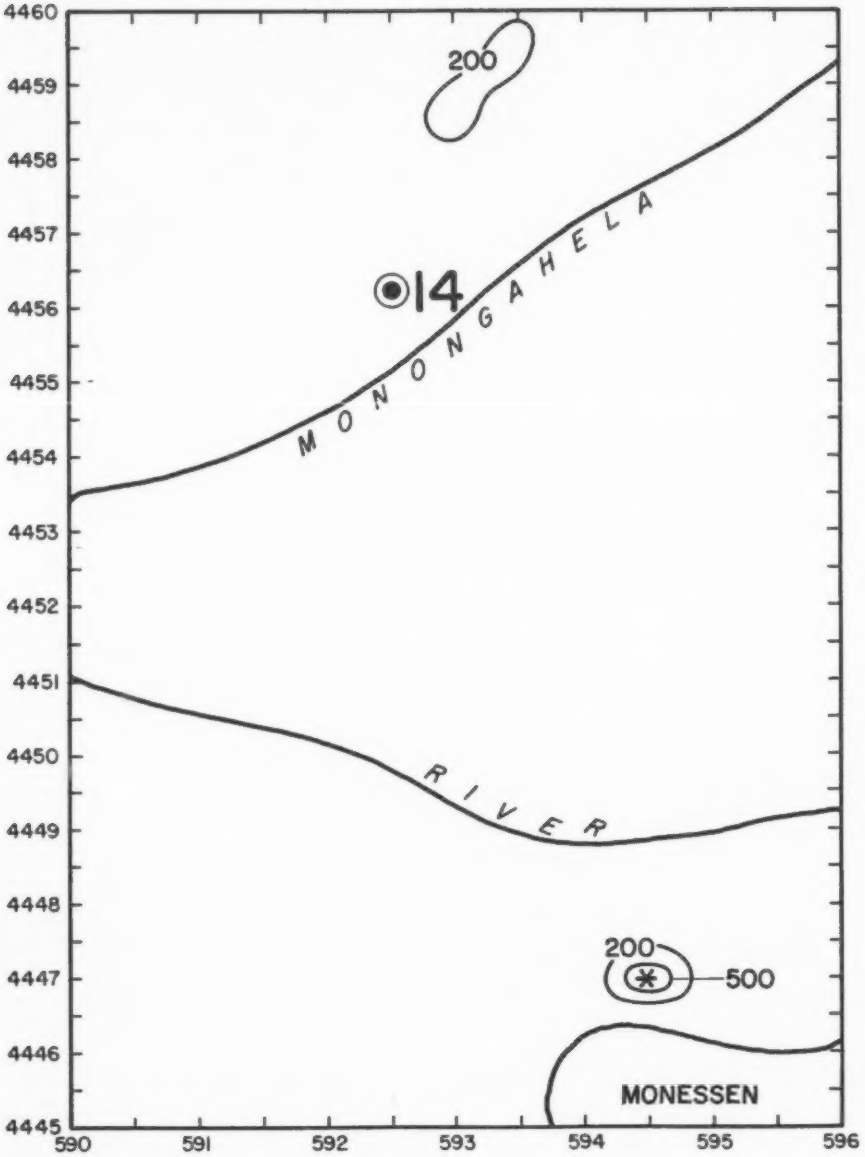

FIGURE 6-3. Isopleths of 3-hour average SO_2 ground-level concentrations in µg/m^3 calculated for the Monessen detail grid using the short-term 1980 compliance emissions inventory. The number 14 refers to the Duquesne Light, Elrama Plant. The asterisk symbol indicates the point of maximum concentration.

SECTION 7

MODEL VALIDATION

Previous model validation studies in which the ground-level SO_2 concentrations calculated by the LONGZ and SHORTZ computer programs have been directly compared with measured values of average annual and short-term SO_2 concentrations are described in reports by Cramer, et al. (1975; 1976; 1977) and by Bjorklund and Bowers (1979). The results of these previous validation studies show that, on the average, the annual SO_2 concentrations calculated using the LONGZ program are within about 10 percent of the corresponding measured values. Similarly, the 3-hour and 24-hour concentrations calculated by the SHORTZ program are within about 20 percent of the corresponding measured values when reasonable allowance is made for the fact that the mean hourly wind direction measurements used in the model to fix the exact position of hourly mean plume centerlines with respect to SO_2 monitor locations are reported only to the nearest 10 degrees. It is important to recognize that the maximum source-receptor distances in these previous model validation studies are of the order of 10 kilometers and we have not been able to test the accuracy of LONGZ and SHORTZ model calculations for source-receptor distances greater than about 30 kilometers. We also point out that the results of all model validation studies are critically dependent on the accuracy and representativeness of both the emissions inventory and air quality measurements as well as the accuracy and representativeness of the meteorological observations used in the studies. As explained below, we originally planned to use 1975 emissions inventory data, meteorological data and SO_2 monitor data in the validation study of the LONGZ and SHORTZ model calculations for the Southwest Pennsylvania AQCR. However, principally because of deficiencies in the SO_2 monitor data, it was necessary to use various combinations of emissions inventory, meteorological and SO_2 monitor data for the years 1976 through 1979 in the model validation study.

7.1 SO_2 MONITOR DATA USED FOR MODEL VALIDATION

During 1975, the Pennsylvania Department of Environmental Resources (DER) operated continuous SO_2 monitors within the Southwest Pennsylvania AQCR at four COPAMS stations: New Castle, Beaver Falls, Baden and Charleroi. Copies of the hourly SO_2 concentration measurements for 1975 from these four stations were obtained from DER and from the EPA air quality measurement retrieval system SAROAD. Both data sets showed valid data retrieval rates ranging from 11 to about 45 percent which are too low for use in validating long-term dispersion-model calculations. The Allegheny County Burea of Air Pollution Control (BAPC) operated a network of seven continuous SO_2 monitors in 1975. However, during this period, there were serious problems with calibration procedures and instrument operations at all of these monitoring sites. Because of the resulting uncertainties in the measurements, the 1975 Allegheny County BAPC SO_2 monitoring data are also unsuitable for model validation purposes.

The lack of adequate SO_2 monitor data for 1975 thus forced the use of SO_2 measurements for other years in validating the dispersion models. The Allegheny County BAPC provided us with annual average SO_2 monitor data for 1976. The Pennsylvania DER replaced the SO_2 monitors at the COPAMS stations in 1978. Since this replacement, the valid data recovery rates have improved but are still below desirable levels. We used the annual average SO_2 monitor data for 1978 and 1979 from the following DER stations in the model validation study:

- New Castle
- Beaver Falls
- Baden
- Midland

The valid data retrieval rates at these stations during 1978 and 1979 ranged from 31 percent at New Castle to 58 percent at Midland. The Pennsylvania Power Company has operated an SO_2 monitoring network in the vicinity of the Bruce Mansfield Power Station since 1974. Measurements from three continuous monitors in this network made during 1977 were used for both the long-term and short-term model validation. The names of these Pennsylvania Power Company monitor stations are: Fairview, Western Beaver and Route 68. Table 7-1 lists the SO_2 monitor sites and periods of observation used in validating the LONGZ dispersion-model calculations. Locations of the monitor sites are shown in Figure 5-1 and in Table 5-1. In validating the SHORTZ dispersion-model calculations, we used only the Pennsylvania DER and Pennsylvania Power Company monitor data.

7.2 SO_2 EMISSIONS INVENTORY DATA USED FOR MODEL VALIDATION

The emissions inventory data used for model validation were obtained from four agencies:

- Pennsylvania Department of Environmental Resources (DER)
- Allegheny County Burea of Air Pollution Control (BAPC)
- EPA Region III
- West Virginia Air Pollution Control Commission

The Pennsylvania DER supplied the emissions inventory for sources located within Pennsylvania that were outside of Allegheny County. This DER inventory is based on product or fuel through-put for the years 1976 and 1977 and was reviewed and updated by DER personnel for the model validation study. The emissions inventory for sources located in Allegheny County, which was developed by the Allegheny County BAPC, is based on the actual operating levels for 1976 and includes quarterly operating data for the U. S. Steel sources. The 1976 SO_2 emissions inventory for Allegheny County sources used for model validation reflects updates and changes made jointly by the Allegheny County BAPC and EPA Region III. The SO_2 emissions inventory for sources located in West Virginia was developed by the West Virginia

TABLE 7-1

COMPARISON OF CALCULATED AND OBSERVED ANNUAL GROUND LEVEL SO_2 CONCENTRATIONS

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$))	$\frac{\text{Observed}}{\text{Calculated}}$	Calculated Concentration (µg/m3)	$\frac{\text{Observed}}{\text{Calculated}}$
Baden (DER)	9/78 - 8/79	81.2	153.5	0.53	243.3	0.33
Beaver (DER)	9/78 - 8/79	47.2	43.1	1.10	47.4	1.00
New Castle (DER)	9/78 - 8/79	39.3	29.1	1.35	33.9	1.16
Midland (DER)	1979	78.6	112.5	0.70	120.5	0.65
Fairview (Penn Power)	1977	109.4	77.4	1.41	69.7	1.57
Western Beaver (Penn Power)	1977	85.2	97.5	0.87	85.2	1.00
Route 68 (Penn Power)	1977	101.0	89.0	1.14	81.1	1.24
Liberty Boro (BAPC)	1976	104.0	133.3	0.78	141.1	0.74
Downtown (BAPC)	1976	73.0	75.5	0.97	69.9	1.04
Hazelwood (BAPC)	1976	141.5	354.2	0.40	406.8	0.35

TABLE 7-1 (Continued)

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$)	$\frac{\text{Observed}}{\text{Calculated}}$	Calculated Concentration ($\mu g/m^3$)	$\frac{\text{Observed}}{\text{Calculated}}$
Glassport (BAPC)	1976	96.0	91.6	1.05	97.7	0.98
North Braddock (BAPC)	1976	91.0	98.4	0.92	112.4	0.81
Logans Ferry (BAPC)	1976	73.0	57.5	1.27	66.8	1.09

Air Pollution Control Commission and is based on typical source operations. The emissions inventory for sources located in Ohio was developed from industrial source information supplied by the Ohio Environmental Protection Agency to EPA Region III and from information on Ohio power plants contained in reports published by the Federal Power Commission. The annual emission rates for the Ohio power plants were set at 65 percent of the maximum generating capacity. The 1976/1977 SO_2 emissions inventory used for the model validation calculations is listed in Appendix C.3.

7.3 LONG-TERM VALIDATION CALCULATIONS

Because the SO_2 emissions inventory supplied by the Pennsylvania DER covers both 1976 and 1977, and the emissions inventory provided by the Allegheny County BAPC is for 1976, we made average annual concentration calculations with the long-term dispersion model LONGZ for both 1976 and 1977. The meteorological inputs used in these calculations were developed from the 1976 and 1977 hourly observations made at the Greater Pittsburgh Airport, following the procedures described in Section 3. The detailed tabulations of seasonal and annual meteorological inputs for 1976 and 1977 are contained in Appendices B.2 and B.3.

The long-term dispersion model LONGZ was executed with the 1976/1977 emissions inventory listed in Appendix C.3 and the 1976, 1977 Greater Pittsburgh Airport meteorological inputs to calculate annual average ground-level concentrations at the SO_2 monitor sites listed in Table 7-1. The locations of these monitor sites are also shown in Figure 5-1 and the UTM coordinates and site elevations are given in Table 5-1. It is apparent from the discussion of monitor data for model validation in Section 7.1 and from Table 7-1 that the observation periods for the four Pennsylvania DER monitors (Baden, Beaver, New Castle and Midland) are for 1978 and 1979, while the emissions inventory and meteorological data used in the model calculations are for 1976 and 1977.

Consequently, there are serious reservations, for model validation purposes, about the significance of any comparisons made between the model calculations for these monitor sites and the observed concentrations.

The observed and calculated annual average SO_2 concentrations at all monitor sites are shown in Table 7-1 together with the ratios of the observed concentration and the calculated 1976 and 1977 concentrations at each monitor site. There are three ratios in the table that are less than 0.5 which indicates that the model concentrations overpredict the observed concentration by more than a factor of two. One of these low ratios occurs at the Baden monitor when the annual average concentration for 1977 calculated by the LONGZ computer program is used to form the ratio. The other two low ratio values occur at the Hazelwood monitor where the calculated annual average concentrations for both 1976 and 1977 are much larger than the observed 1976 concentration. We have not investigated the possible reasons for the model overprediction at the Baden monitor site because the observed concentration is for the period from September 1978 through August 1979 while the calculated concentrations were made on the basis of the 1976/1977 emissions inventory and the 1976 and 1977 meteorological data from the Greater Pittsburgh Airport. However, the large model overpredictions at the Hazelwood monitor are of serious concern and, as described below, we have made a detailed analysis of the 1976 annual average concentrations calculated by the LONGZ computer program in the immediate vicinity of the Hazelwood monitor.

If the observed and calculated values at all the monitor sites in Table 7-1 are accepted at face value, the overall average ratio of observed and calculated concentrations is 0.79 when the calculated 1976 concentrations are used; the value of the overall average ratio is 0.71 when the calculated 1977 concentrations are used. If the Hazelwood monitor is excluded from consideration, the overall average ratio values are 0.92 and 0.84 for 1976 and 1977, respectively. If both the Baden and

Hazelwood monitors are excluded, the values of the overall average ratio are 0.99 for 1976 and 0.97 for 1977. We conclude that, except for the Hazelwood and Baden monitors, the annual average SO_2 concentrations calculated by the LONGZ computer program are in good agreement with the annual average concentrations measured at the SO_2 monitor sites.

Figure 7-1 shows the isopleths of the 1976 annual average SO_2 ground-level concentration within a distance of about 1 kilometer from the Hazelwood monitor calculated by the LONGZ computer program. The location of the monitor is indicated by the filled triangle near the center of the figure. The asterisks show the locations of individual sources within the J & L Pittsburgh source complex which is designated by the number 7. The important feature in Figure 7-1 is the very large spatial concentration gradient within an area of about 1 square kilometer centered on the monitor site. Calculated values equal to the annual average concentration of 141.5 micrograms per cubic meter observed at the Hazelwood monitor in 1976 occur at a distance of about 0.5 kilometers south and northwest of the monitor. Although we are not able to explain the differences between the model calculations and the observed concentration at the monitor, the calculated isopleth concentration pattern in Figure 7-1 illustrates the need for an increase in the density of the monitoring network in the vicinity of major SO_2 sources to define accurately the ambient air quality.

7.4 SHORT-TERM VALIDATION CALCULATIONS

The SO_2 monitor data available for validating the short-term dispersion-model calculations for the five grid areas of the Southwest Pennsylvania AQCR are very limited. The Pennsylvania DER provided 3-hour and 24-hour maximums measured at the New Castle and Beaver monitor sites for the 12-month period from September 1978 through August 1979. We also obtained summaries of the SO_2 concentration measurements, made during 1977 by the Pennsylvania Power Company in the vicinity of the Bruce

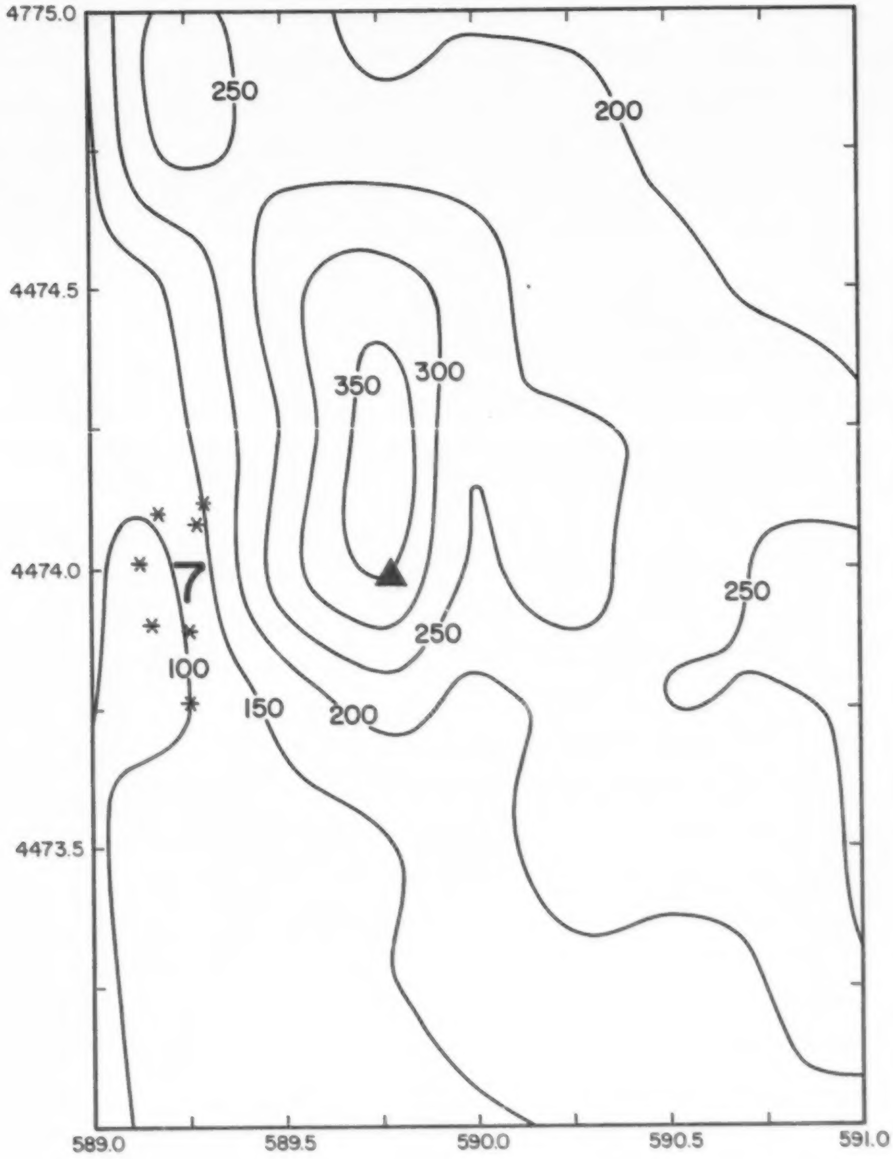

FIGURE 7-1. Isopleths of calculated 1976 annual average SO_2 ground-level concentration in micrograms per cubic meter for the vicinity of the Hazelwood monitor. The monitor location is indicated by the filled triangle. The asterisks show the location of individual sources within the J & L Pittsburgh source complex which is designated by the number 7.

Mansfield Plant, which were above the 3-hour and 24-hour NAAQS for SO_2. No SO_2 monitor data are available for the Monessen grid. Because of these severe limitations in the short-term SO_2 monitor data, as well as the uncertainties involved in applying the 1976/1977 annual emissions inventory and hourly meteorological observations from the Greater Pittsburgh Airport to the specific 3-hour and 24-hour time periods for which SO_2 monitor data are available, direct comparisons of short-term model calculations with SO_2 monitor data are of questionable value. For these reasons, we decided to limit the short-term model validation study to comparisons of SHORTZ model calculations, made using the 1976/1977 emissions inventory in Appendix C.3 and the hourly meteorological inputs for 28 August 1976 in Table 6-1, with the highest short-term SO_2 concentrations measured at the monitor sites mentioned above.

The maximum 3-hour and 24-hour average SO_2 ground-level concentrations calculated by the SHORTZ computer program for the New Castle grid, using the 1976/1977 emissions inventory in Appendix C.3 with the hourly meteorological data for 28 August 1976 in Table 6-1, are 469 and 108 micrograms per cubic meter, respectively. During the 12-month period from September 1978 through August 1979, the maximum 3-hour average SO_2 concentration measured at the DER New Castle monitor site was 550 micrograms per cubic meter as compared with the calculated concentration of 469 micrograms. The maximum 24-hour average SO_2 concentration measured during this 12-month period at the New Castle monitor was 128 micrograms per cubic meter as compared with the calculated maximum of 108 micrograms per cubic meter.

The maximum 3-hour and 24-hour SO_2 concentrations calculated by the SHORTZ computer program for 28 August 1976 at grid points near the West Penn Fairview monitor, which is located at the eastern edge of the Northwest Border calculation grid (see Figure 5-1), are 1190 and 333 micrograms per cubic meter, respectively. The maximum 3-hour average SO_2

concentration measured at the Fairview monitor during 1977 was 1387.7 micrograms per cubic meter and the maximum 24-hour average SO_2 concentration measured during 1977 at the Fairview monitor was 528.2 micrograms per cubic meter. Of the 11 cases during 1977 when the 24-hour average SO_2 concentrations measured at the Fairview monitor exceeded the 24-hour NAAQS, the prevailing wind directions reported by the Pennsylvania Power Company were between south and west-southwest for 8 cases which include the case of the maximum observed 24-hour average. The reported average wind directions for the other 3 cases were between east-northeast and east-southeast. For the two cases during 1977 in which the 3-hour average SO_2 concentrations were above the 3-hour NAAQS, the reported average wind directions were from the southeast and south-southeast. Concurrent hourly observations from the Greater Pittsburgh Airport show low wind speeds and variable wind directions during the periods for these three cases.

We conclude that the 24-hour average concentrations calculated by the SHORTZ computer program using the 28 August 1976 meteorological data are supported by the limited SO_2 monitor data which are available for the New Castle, Beaver and Western Border grids. The maximum 3-hour average concentrations calculated by the SHORTZ program for these grids, using the 28 August 1976 meteorological data, are lower than the maximum 3-hour SO_2 concentrations measured at the monitor sites. The prevailing wind directions reported by the Pennsylvania Power Company for the Bruce Mansfield Plant, for the period in which the maximum 3-hour SO_2 concentrations were measured at the Fairview monitor during 1977, indicate that the worst-case 3-hour meteorology may be different from that represented by the 28 August 1976 observation from the Greater Pittsburgh Airport used in the SHORTZ model validation calculations. However, a detailed short-term model validation study which would provide the requisite objective comparison of SO_2 monitor data with model predictions is beyond the scope of this study and is probably not possible because of the limitations in the existing emissions, meteorological and SO_2 monitor data.

SECTION 8

PRELIMINARY CALCULATIONS OF SO_2 CONCENTRATIONS ALONG THE PERIMETER OF THE SOUTHWEST PENNSYLVANIA AQCR

8.1 LONG-TERM CALCULATIONS

The results of the long-term model calculations of SO_2 ground-level concentrations made for the gross calculation grid (See Figure 5-1), using the annual 1980 compliance emissions inventory showed calculated annual average concentrations above the annual SO_2 NAAQS of 80 micrograms per cubic meter along the western border of Pennsylvania with Ohio and West Virginia. For this reason, the two Western Border grids 3 and 4 in Figure 5-1, which are outside of the Beaver and Monongahela Valley Air Basins, were included in the detailed model calculations. In the calculations made using the annual 1980 compliance emissions inventory, concentrations above the annual standard of 80 micrograms per cubic meter occur in a narrow strip approximately 17 kilometers long and 3 kilometers wide located principally in the Southwest Border grid. Figure 8-1 shows the calculated SO_2 isopleths for the Western Border area. The calculated maximum annual average SO_2 concentration of 101.4 micrograms per cubic meter occurs in the Southwest Border grid (4) at a grid point with the UTM X and Y coordinates of 541.0 and 4472.5 kilometers, respectively. At this point, Ohio sources contributed 35.8 micrograms per cubic meter (35 percent), West Virginia sources contributed 54.0 micrograms per cubic meter (53 percent) and all of the Pennsylvania sources contribute 11.5 micrograms per cubic meter (11 percent) to the total. The contributions of individual major SO_2 sources and source complexes in Ohio and West Virginia to the calculated maximum ranges from about 5 micrograms per cubic meter to 20 micrograms per cubic meter. It thus appears that no single source or source complex is responsible for producing the high calculated ground-level concentrations.

There are points within the area of the calculated exceedance of the annual standard where Ohio sources contribute more than 50 percent of

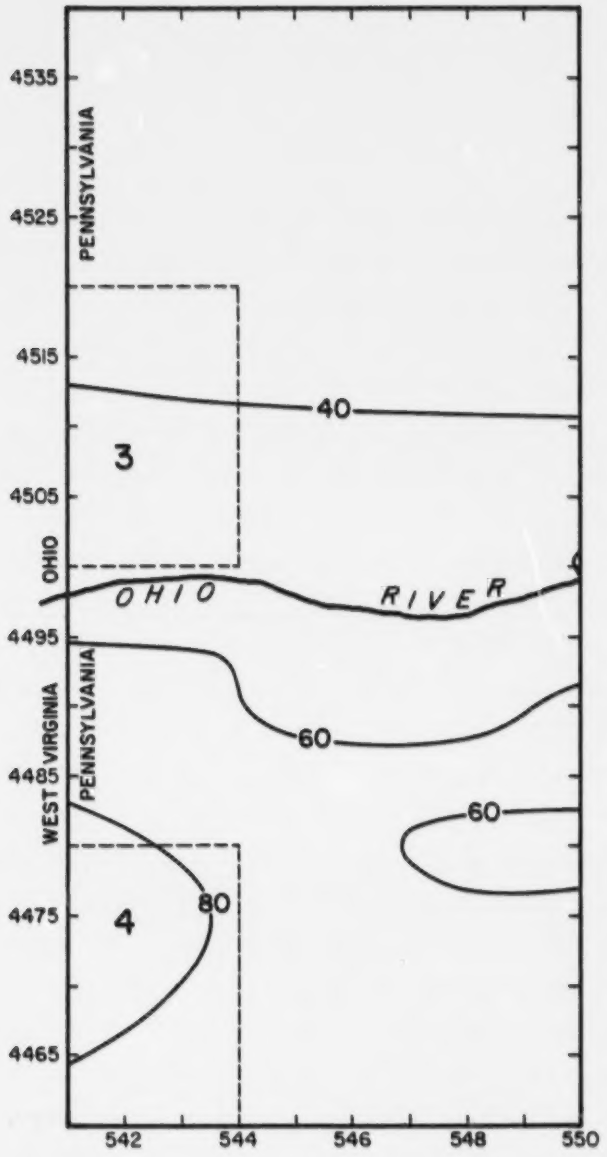

FIGURE 8-1. Isopleths of annual average SO_2 concentration in μg/m^3 calculated for the Western Border area of the Southwest Pennsylvania AQCR using the LONGZ computer program with the annual 1980 compliance emissions inventory. The numbers 3 and 4 refer to the Northwest Border and Southwest Border calculation grids, respectively.

the calculated concentration. At the point with UTM coordinates X=541.0 kilometers and Y=4482.5 kilometers, the concentration is 83.9 micrograms per cubic meter. Ohio sources contribute 46.4 micrograms per cubic meter, West Virginia sources contribute 26.3 micrograms per cubic meter, and the remainder of 11.2 micrograms per cubic meter is contributed by sources in Pennsylvania. Thus, the sources in Ohio and West Virginia are jointly responsible, according to these calculations, for the high concentrations in the border areas.

8.2 SHORT-TERM CALCULATIONS

The two Western Border grids were also included in the model calculations made using the short-term 1980 compliance emissions inventory. Ground-level concentrations above the 24-hour NAAQS were calculated within a very small area of approximately 3 square kilometers in the Southwest Border grid. The calculated maximum concentration of 425.2 micrograms per cubic meter occurs at the grid point with UTM coordinates X=544.0 kilometers and Y=4,466.0 kilometers. At this point, Ohio sources contributed 60.6 micrograms per cubic meter, West Virginia sources contributed 352.1 micrograms per cubic meter and Pennsylvania sources contributed 12.4 micrograms per cubic meter to the total concentration.

A maximum 3-hour SO_2 concentration of 2,375 micrograms per cubic meter was calculated at the same grid point at which the calculated 24-hour maximum occurred. Practically all of this maximum (2,368 micrograms per cubic meter) is contributed by sources located in West Virginia. We found several other cases in which the calculated 3-hour maximum concentrations were above 2,000 micrograms per cubic meter. These concentrations are also almost entirely due to sources in West Virginia. However, calculations necessary to define the maximum 3-hour and 24-hour concentrations due to sources located in Ohio and/or West Virginia were not made.

Additionally, there is some indication from the short-term calculations that there may be an area of high ground-level concentration near the Hatfield Power station. We calculated a 24-hour SO_2 concentration of approximately 200 micrograms per cubic meter produced by Hatfield emissions at the extreme southern edge of the Monnessen grid on 28 August 1976 in the presence of southerly winds. The calculated maximum 3-hour concentration produced by emissions from the Hatfield Power Station at the southern boundary of the Monnessen grid was approximately 650 micrograms per cubic meter.

We point out that the model calculations for the border areas described above were made using worst-case meteorological conditions selected for other areas and may not be representative of the worst-case situations for the border areas. In addition, there are some questions about the validity of the emissions inventory data for the West Virginia and Ohio sources. While the results of our model calculations serve to point out potential air quality problems in these border areas, an additional effort beyond the scope of the present study is required to establish the magnitude and areal extent of high SO_2 concentrations along the western and southern perimeter of the Southwest Pennsylvania AQCR.

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APPENDIX A

MATHEMATICAL MODELS USED TO CALCULATE GROUND-LEVEL CONCENTRATIONS

A.1 INTRODUCTION

The computerized diffusion models described in this appendix fall into two general categories: (1) Short-term models for calculating time-averaged ground-level concentrations for averaging times of 1, 3, 8, and 24 hours; (2) Long-term models for calculating seasonal and annual ground-level concentrations. Both the short-term and long-term concentration models are modified versions of the Gaussian plume model for continuous sources described by Pasquill (1962). In the short-term model, the plume is assumed to have Gaussian vertical and lateral concentration distributions. The long-term model is a sector model similar in form to the Environmental Protection Agency's Climatological Dispersion Model (Calder, 1971) in which the vertical concentration distribution is assumed to be Gaussian and the lateral concentration distribution within a sector is rectangular (a smoothing function is used to eliminate sharp discontinuities at the sector boundaries). Vertical plume growth (σ_z) in the short-term and long-term models and lateral plume growth (σ_y) in the short-term model are calculated by using turbulent intensities in simple power-law expressions that include the effects of initial source dimensions. In both the short-term and long-term models, buoyant plume rise is calculated by means of the Briggs (1971; 1972) plume-rise formulas, modified to include the effects of downwash in the lee of the stack during periods when the wind speed at stack height equals or exceeds the stack exit velocity. An exponent law is used to adjust the surface wind speed to the source height for plume-rise calculations and to the plume stabilization height for the concentration calculations. Both the short-term and the long-term models contain provisions to account for the effects of complex terrain.

Table A-1 lists the hourly meteorological inputs required by the short-term concentration model. Lateral and vertical turbulent intensities σ'_A and σ'_E may be directly specified or may be assigned on the basis of the Pasquill stability category (see Section 3 of Cramer, et al., 1975). The Pasquill stability cateogry is determined from surface weather observations using the Turner (1964) wind-speed and solar-index values. Mixing depths may be obtained from rawinsonde or pibal measurements, or they may be assigned on the basis of tabulations of the frequency of occurrence of wind speed and mixing depth (available from the National Climatic Center for synoptic rawinsonde stations). Potential temperature gradients may be obtained from measurements or assigned on the basis of climatology.

Table A-2 lists the meteorological inputs required by the long-term concentration model. Joint-frequency distributions of wind-speed and wind-direction categories, classified according to the Pasquill stability categories, are available from the National Climatic Center. Alternately, surface wind observations may be analyzed to generate wind-frequency distributions by time-of-day categories (night, morning, afternoon and evening). Vertical turbulent intensities may be determined from a climatology of actual measurements or may be assigned on the basis of the Pasquill stability categories. Median mixing depths may be determined from the seasonal tabulations of the frequency of occurrence of wind-speed and mixing depth prepared by the National Climatic Center. Vertical potential temperature gradients may be assigned to the combinations of wind-speed and stability or time-of-day categories on the basis of climatology.

Table A-3 lists the source input parameters required by the short-term and long-term diffusion models. As shown by the table, the computerized short-term and long-term models calculate ground-level concentrations produced by emissions from stacks, building vents and roof monitors, and from area sources. Both the short-term and long-term models also use a Cartesian coordinate system (usually the Universal Transverse Mercator system) with the positive X axis directed toward the east and the positive Y axis directed toward the north.

TABLE A-1

HOURLY METEOROLOGICAL INPUTS REQUIRED BY THE SHORT-TERM CONCENTRATION MODEL

Parameter	Definition
$\bar{u}_R$	Mean wind speed at height z_R (m/sec)
θ	Mean wind direction at height z_R (deg)
p	Wind-profile exponent
σ'_A	Wind azimuth-angle standard deviation in radians
σ'_E	Wind elevation-angle standard deviation in radians
T_a	Ambient air temperature ($^{\circ}$K)
H_m	Depth of surface mixing layer (m)
$\frac{\partial\theta}{\partial z}$	Vertical potential temperature gradient ($^{\circ}$K/m)

TABLE A-2

METEOROLOGICAL INPUTS REQUIRED BY THE LONG-TERM CONCENTRATION MODEL

Parameter	Definition
$f_{i,j,k,\ell}$ (Table)	Frequency distribution of wind-speed and wind-direction categories by stability or time-of-day categories for the ℓ^{th} season
$p_{k,i}$ (Table)	Wind-profile exponent for each stability or time-of-day category and i^{th} wind-speed category
$\sigma'_{E;i,k}$ (Table)	Standard deviation of the wind-elevation angle in radians for the i^{th} wind-speed category and k^{th} stability or time-of-day category
$T_{a;k,\ell}$ (Table)	Ambient air temperature for the k^{th} stability or time-of-day category and ℓ^{th} season (°K)
$\left(\frac{\partial\theta}{\partial z}\right)_{i,k}$ (Table)	Vertical potential temperature gradient for the i^{th} wind-speed category and k^{th} stability or time-of-day category (°K/m)
$H_{m;i,k,\ell}$ (Table)	Median surface mixing depth for the i^{th} wind-speed category, k^{th} stability or time-of-day category and ℓ^{th} season (m)
$\bar{u}\,(z_R)_i$ (Table)	Mean wind speed at height z_R for the i^{th} wind-speed category (m/sec)

TABLE A-3

SOURCE INPUTS REQUIRED BY THE SHORT-TERM AND LONG-TERM CONCENTRATION MODELS

Parameter	Definition
Stacks	
Q	Pollutant emission rate (mass per unit time)
X, Y	X and Y coordinates of the stack (m)
z_s	Elevation above mean sea level of the base of the stack (m)
h	Stack height (m)
v	Actual volumetric emission rate (m^3/sec)
T_s	Stack exit temperature (^oK)
r	Stack inner radius (m)
Building Sources	
Q	Pollutant emission rate (mass per unit time)
X, Y	X and Y coordinates of the center of the building (m)
z_s	Elevation above mean sea level of the base of the building (m)
h	Building height (m)
L	Building length (m)
W	Building width (m)
δ	Angle measured clockwise between north and the long side of the building (deg)
Area Sources	
Q	Pollutant emission rate (mass per unit time)
X, Y	X and Y coordinates of the center of the area source (m)
z_s	Elevation above mean sea level of the area source (m)

TABLE A-3 (Continued)

Parameter	Definition
Area Sources (Continued)	
h	Characteristic vertical dimension of the area source (m)
L	Length of the area source (m)
W	Width of the area source (m)
δ	Angle measured clockwise between north and the long side of the area source (deg)

A.2 PLUME-RISE FORMULAS

The effective stack height H of a buoyant plume is given by the sum of the physical stack height h and the buoyant rise Δh. For an adiabatic or unstable atmosphere, the buoyant rise Δh_N is given by

$$\Delta h_N = \left[\frac{1}{\bar{u}\,\{h\}} \left(\frac{3F}{2\gamma_1^{\,2}} \right)^{1/3} (10h)^{2/3} \right] f \qquad \text{(A-1)}$$

where the expression in the brackets is from Briggs (1971; 1972) and

$\bar{u}\{h\}$ = the mean wind speed at the stack height h (m/sec)
γ_1 = the adiabatic entrainment coefficient ~ 0.6 (Briggs, 1972)
F = The initial buoyancy flux (m^4/sec^3)

$$= \frac{gV}{\pi} \left(1 - \frac{T_a}{T_s} \right) \qquad \text{(A-2)}$$

V = The volumetric emission rate of the stack (m^3/sec)
$= \pi\, r^2\, w$
r = inner radius of stack (m)
w = stack exit velocity (m/sec)
g = the acceleration due to gravity (m/sec^2)
T_a = the ambient air temperature (°K)
T_s = the stack exit temperature (°K)

The factor f, which limits the plume rise as the mean wind speed at stack height approaches or exceeds the stack exit velocity, is defined by

$$f = \left\{ \begin{array}{ccc} 1 & ; & \bar{u}\{h\} \leq w/1.5 \\ \left(\dfrac{3w - 3\bar{u}\{h\}}{w}\right) & ; & w/1.5 < \bar{u}\{h\} < w \\ 0 & ; & \bar{u}\{h\} \geq w \end{array} \right\} \qquad \text{(A-3)}$$

The empirical correction factor f is generally not applied to stacks with Froude numbers less than about unity. The corresponding Briggs (1971) rise formula for a stable atmosphere (potential temperature gradient greater than zero) is

$$\Delta h_s = \left\{ \begin{array}{ll} \left[\dfrac{6F}{\bar{u}\{h\}\gamma_2^{\,2}\, S}\right]^{1/3} & ;\pi\ \bar{u}\{h\}\ S^{-1/2} < 10h \\ \left[\dfrac{3F}{\bar{u}\{h\}\gamma_2^{\,2}\, S}\left(1 - \cos\left(\dfrac{10S^{1/2}h}{\bar{u}\{h\}}\right)\right)\right]^{1/3} & ;\pi\ \bar{u}\{h\}\ S^{-1/2} \geq 10h \end{array} \right\} f \qquad \text{(A-4)}$$

where

γ_2 = the stable entrainment coefficient ~ 0.66 (Briggs, 1972)

$S = \dfrac{g}{T_a} \dfrac{\partial\theta}{\partial z}$

$\dfrac{\partial\theta}{\partial z}$ = vertical potential temperature gradient (^{o}K/m)

The entrainment coefficients γ_1 and γ_2 are based on the suggestions of Briggs (1972). It should be noted that Equation (A-4) does not permit the calculated stable rise Δh_s to exceed the adiabatic rise Δh_N as the atmosphere approaches a neutral stratification ($\partial\theta/\partial z$ approaches 0). A procedure of this type is recommended by Briggs (1972).

A.3 SHORT-TERM CONCENTRATION MODEL

A.3.1 Elevated Sources

The atmospheric dispersion model used to calculate hourly average ground-level concentrations downwind from an elevated continuous source is given by

$$\{\chi\}x,y = \frac{K\,Q}{\pi\ \bar{u}\{H\}\sigma_y\ \sigma_z}\ \{\text{Vertical Term}\}\ \{\text{Lateral Term}\}\ \{\text{Decay Term}\} \quad \text{(A-5)}$$

where

K = scaling coefficient to convert input parameters to dimensionally consistent units

Q = source emission rate (mass per unit time)

$\bar{u}\{H\}$ = mean wind speed at the plume stabilization height H (m/sec)

σ_y, σ_z = standard deviations of the lateral and vertical concentration distributions at downwind distance x (m)

The Vertical Term refers to the plume expansion in the vertical or z direction and includes a multiple reflection term that limits cloud growth to the surface mixing layer.

$$\{\text{Vertical Term}\} = \left\{\exp\left[-\frac{1}{2}\left(\frac{H}{\sigma_z}\right)^2\right] + \sum_{n=1}^{\infty}\left[\exp\left[-\frac{1}{2}\left(\frac{2n\ H_m + H}{\sigma_z}\right)^2\right] + \exp\left[-\frac{1}{2}\left(\frac{2n\ H_m - H}{\sigma_z}\right)^2\right]\right]\right\} \quad \text{(A-6)}$$

where H_m is the depth of the surface mixing layer. The exponential terms in the infinite series in Equation (A-6) rapidly approach zero near the source. At the downwind distance where the exponential terms exceed exp(-10) for n equal 3, the plume has become approximately uniformly mixed within the surface mixing layer. In order to shorten computer computation time, Equation (A-6) is changed to the form

$$\{\text{Vertical Term}\} = \frac{\sqrt{2\pi}\,\sigma_z}{2H_m} \qquad \text{(A-7)}$$

beyond this point. Equation (A-7) changes the form of the vertical concentration distribution from Gaussian to rectangular. If H exceeds H_m, the Vertical Term is set equal to zero which results in a zero value for the ground-level concentration.

The Lateral Term refers to the crosswind expansion of the plume and is given by the expression

$$\{\text{Lateral Term}\} = \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right] \qquad \text{(A-8)}$$

where y is the crosswind distance from the plume centerline to the point at which concentration is calculated.

The Decay Term, which accounts for the possibility of pollutant removal by physical or chemical processes, is of the form

$$\{\text{Decay Term}\} = \exp\left[-\psi\, x/\bar{u}\{H\}\right] \qquad \text{(A-9)}$$

where

ψ = the washout coefficient Λ (sec^{-1}) for precipitation scavenging

$= \frac{0.692}{T_{1/2}}$, where $T_{1/2}$ is the pollutant half life in seconds for physical or chemical removal

= 0 for no depletion (ψ is automatically set to zero by the computer program unless otherwise specified)

In the model calculations, the observed mean wind speed $\bar{u}_R$ is adjusted from the measurement height z_R to the source height h for plume-rise calculations and to the stabilization height H for the concentration calculations by a wind-profile exponent law

$$\bar{u}\{z\} = \bar{u}\{z_R\} \left(\frac{z}{z_R}\right)^p \qquad \text{(A-10)}$$

The exponent p, which is assigned on the basis of atmospheric stability, ranges from about 0.1 for very unstable conditions to about 0.4 for very stable conditions.

According to the derivation in the report by Cramer, et al. (1972), the standard deviation of the lateral concentration distribution σ_y is given by the expression

$$\sigma_y\{x\} = \sigma_A' \, x_{ry} \left[\frac{x + x_y - x_{ry}(1-\alpha)}{\alpha x_{ry}}\right]^\alpha \qquad \text{(A-11)}$$

$$x_y = \left\{\begin{array}{ll} \dfrac{\sigma_{yR}}{\sigma_A'} - x_R & ; \dfrac{\sigma_{yR}}{\sigma_A'} \leq x_{ry} \\ & \\ \alpha x_{ry} \left(\dfrac{\sigma_{yR}}{x_{ry} \, \sigma_A'}\right)^{1/\alpha} - x_R + x_{ry}(1-\alpha) & ; \dfrac{\sigma_{yR}}{\sigma_A'} > x_{ry} \end{array}\right\} \qquad \text{(A-12)}$$

where

σ'_A = the standard deviation of the wind-azimuth angle in radians

x_{ry} = distance over which rectilinear plume expansion occurs downwind from an ideal point source (~50 meters)

σ_{yR} = the standard deviation of the lateral concentration distribution at downwind distance x_R (m)

α = the lateral diffusion coefficient (~0.9)

The virtual distance x_y is not permitted to be less than zero. The lateral turbulent intensity σ'_A may be specified directly or may be assigned on the basis of the Pasquill stability category.

Following the derivation of Cramer, et al. (1972) and setting the vertical diffusion coefficient β equal to unity, the standard deviation of the vertical concentration distribution σ_z is given by the expression

$$\sigma_z\{x\} = \sigma'_E \left(x + x_z\right) \tag{A-13}$$

$$x_z = \left\{ \begin{array}{lll} \frac{\sigma_{zR}}{\sigma'_E} - x_R & ; & \frac{\sigma_{zR}}{\sigma'_E} \geq x_R \\ & & \\ 0 & ; & \frac{\sigma_{zR}}{\sigma'_E} < x_R \end{array} \right\} \tag{A-14}$$

where

σ'_E = standard deviation of the wind-elevation angle in radians

σ_{zR} = the standard deviation of the vertical concentration distribution at downwind distance x_R (m)

The vertical turbulent intensity σ'_E may also be obtained from direct measurements or may be assigned according to the Pasquill stability categories. When σ'_E values corresponding to the Pasquill stability categories are entered in Equation (A-13), the resulting curves will differ from the corresponding Pasquill-Gifford curves in that Equation (A-13) assumes rectilinear expansion at all downwind distances. Thus, σ_z values obtained from Equation (A-13) will be smaller than the values obtained from the Pasquill-Gifford A and B curves and larger than the values obtained from the D, E and F curves at long downwind distances. However, the multiple reflection term in Equation (A-6), which confines the plume to the surface mixing layer, accounts for the behavior of the D, E and F curves (decrease in the expansion rate with distance) in a manner that may be related to the meteorology of the area.

Following the recommendations of Briggs (1972), the lateral and vertical standard deviations of a stabilized buoyant plume are defined by

$$\sigma_{yR} = \sigma_{zR} = \frac{0.5\ \Delta h}{2.15} \qquad \text{(A-15)}$$

The downwind distance to stabilization x_R is given by

$$x_R = \left\{ \begin{array}{lll} 10h & ; & \frac{\partial\theta}{\partial z} \leq 0 \\ \pi\ \bar{u}(h)\ S^{-1/2} & ; & \frac{\partial\theta}{\partial z} > 0 \text{ and } \pi\ \bar{u}(h)\ S^{-1/2} < 10h \\ 10h & ; & \frac{\partial\theta}{\partial z} > 0 \text{ and } \pi\ \bar{u}(h)\ S^{-1/2} \geq 10h \end{array} \right\} \qquad \text{(A-16)}$$

A.3.2 Application of the Short-Term Model to Low-level Emissions

The short-term diffusion model in Section A.3.1 may be used to calculate ground-level concentrations resulting from low-level emissions such as losses through building vents. These emissions are rapidly distributed by the cavity circulation of the building wake and quickly assume the dimensions of the building. Ground-level concentrations are calculated by setting the buoyancy parameter F equal to zero. The standard deviation of the lateral concentration distribution at the source σ_{yo} is defined by the building crosswind dimension y_o divided by 4.3. The standard deviation of the vertical concentration distribution at the source is obtained by dividing the building height by 2.15. The initial dimensions σ_{yo} and σ_{zo} are assumed to be applicable at the downwind edge of the building. These procedures are in good agreement with the results of recent wind-tunnel experiments reported by Huber and Snyder (1976). It should be noted that separate turbulent intensities σ'_A and σ'_E may be defined for the low-level sources to account for the effects of surface roughness elements and heat sources.

A.3.3 Short-Term Concentration Model for Area Sources

The atmospheric dispersion model used to calculate ground-level concentrations at downwind distance x from the downwind edge of an area source is given by the expression

$$\chi\{x, y\} = \frac{K\,Q}{\sqrt{2\pi}\;\bar{u}\{h\}\;\sigma_z\{x\}\;y_o}\;\{\text{Vertical Term}\} \qquad \text{(A-17)}$$

$$\{\text{Lateral Term}\}\;\{\text{Decay Term}\}$$

where

Q = area source strength in units of mass per unit time
y_o = crosswind source dimension (m)

$$\sigma_z\{x\} = \left\{ \begin{array}{ll} \dfrac{\sigma'_E\, x_o}{\ln\left[\dfrac{\sigma'_E(x+x_o)+h}{\sigma'_E(x)+h}\right]} & ; \quad x < 3\, x_o \\ \\ \sigma'_E(x+x_o/2)+h & ; \quad x \geq 3\, x_o \end{array} \right\} \qquad \text{(A-18)}$$

x_o = alongwind dimension of the area source (m)
h = the characteristic height of the area source (m)

The Vertical Term for an area source is given by

$$\{\text{Vertical Term}\} = \left\{ \begin{array}{ll} 1+2\displaystyle\sum_{n=1}^{3} \exp\left[-\frac{1}{2}\left(\frac{2n\, H_m}{\sigma_x\{x\}}\right)^2\right] & ; \quad \dfrac{1}{2}\left(\dfrac{6H_m}{\sigma_z\{x\}}\right)^2 \geq 10 \\ \\ \dfrac{\sqrt{2\pi}\, \sigma_z\{x\}}{2H_m} & ; \quad \dfrac{1}{2}\left(\dfrac{6H_m}{\sigma_z\{x\}}\right)^2 < 10 \end{array} \right\} \qquad \text{(A-19)}$$

The Lateral Term is given by the expression

$$\{\text{Lateral Term}\} = \left\{ \text{erf}\left[\frac{y_o/2 + y}{\sqrt{2}\, \sigma_y\{x\}}\right] + \text{erf}\left[\frac{y_o/2 - y}{\sqrt{2}\, \sigma_y\{x\}}\right] \right\} \qquad \text{(A-20)}$$

where

y_o = crosswind dimension of the area source (m)
y = crosswind distance from the centerline of the area source (m)

and

$$\sigma_y\{x\} = \sigma'_A\ (x+x_o/2) \qquad \text{(A-21)}$$

The Decay Term is given by Equation (A-9) above.

The concentration at points interior to the area source is given by

$$\chi\{x'\} = \frac{2\ K\ Q}{\sqrt{2\pi}\ \bar{u}\{h\}\ x_o\ y_o\ \sigma'_E} \left\{ \ln \left[\frac{\sigma'_E\ (x'+1)+h}{\sigma'_E + h} \right] \right\} \{\text{Vertical Term}\} \qquad \text{(A-22)}$$

where

x' = distance downwind from the upwind edge of the area source (m)

A.4 LONG-TERM CONCENTRATION MODEL

A.4.1 Elevated Sources

The atmospheric dispersion model for elevated point and volume sources is similar in form to the Air Quality Display Model (Environmental Protection Agency, 1969) and the Climatological Dispersion Model (Calder, 1971). In the model, the area surrounding a continuous source of pollutants is divided into sectors of equal angular width corresponding to the class intervals of the seasonal and annual frequency distributions of wind direction. The emission rate during a season or year is partitioned according to the relative wind-direction frequencies. Ground-level concentration fields for each source are translated to a common reference coordinate grid system and summed to obtain the total due to all emissions. For a single source, the mean seasonal concentration at a point (r, θ) is given by

$$\chi_\ell\{r,\theta\} = \frac{2\ K\ Q}{\sqrt{2\pi}\ r\ \ \Delta\theta'} \sum_{i,j,k} \left[\frac{f_{i,j,k,\ell}}{\bar{u}_i \left\{ H_{i,k,\ell} \right\} \sigma_{z;i,k,\ell}} \ S\{\theta\}\, V_{i,k,\ell} \right.$$

$$\left. \exp\left[-\ \psi\ r/\bar{u}_i\ \ H_{i,k,\ell}\} \right] \right] \tag{A-23}$$

$$V_{i,k,\ell} = \exp\left[-\frac{1}{2} \left(\frac{H_{i,k,\ell}}{\sigma_{z;i,k,\ell}} \right)^2 \right] + \sum_{n=1}^{\infty} \left\{ \exp\left[-\frac{1}{2} \left(\frac{2n\ H_{m;i,k,\ell} - H_{i,k,\ell}}{\sigma_{z;i,k,\ell}} \right)^2 \right] \right.$$

$$\left. +\ \exp\left[-\frac{1}{2} \left(\frac{2n\ H_{m;i,k,\ell} + H_{i,k,\ell}}{\sigma_{z;i,k,\ell}} \right)^2 \right] \right\} \tag{A-24}$$

where

$f_{i,j,k,\ell}$ = frequency of occurrence of the i^{th} wind-speed category, j^{th} wind-direction category and k^{th} stability or time-of-day category for the ℓ^{th} season

$\Delta\theta'$ = the sector width in radians

$S\{\theta\}$ = a smoothing function

$$S\{\theta\} = \left\{ \begin{array}{ll} \dfrac{\Delta\theta' - |\theta'_j - \theta'|}{\Delta\theta'} & ;\ \ |\theta'_j - \theta'| \le \Delta\theta' \\ & \\ 0 & ;\ \ |\theta'_j - \theta'| > \Delta\theta' \end{array} \right\} \tag{A-25}$$

θ'_j = the angle measured in radians from north to the centerline of the j^{th} wind-direction sector

θ' = the angle measured in radians from north to the point (r,θ)

As with the short-term model, the Vertical Term given by Equation (A-24) is changed to the form

$$V_{i,k,\ell} = \frac{\sqrt{2\pi}\,\sigma_{z;i,k,\ell}}{2H_{m;i,k,\ell}} \tag{A-26}$$

when the exponential terms in Equation (A-24) exceed exp(-10) for n equal 3. The remaining terms in Equations (A-23) are identical to those previously defined in Section A.3.1 for the short-term model, except that the turbulent intensities and potential temperature gradients may be separately assigned to each wind-speed and/or stability (or time-of-day) category; the ambient air temperatures may be separately assigned to each stability (or time-of-day) category for each season; and the surface mixing depths may be separately assigned to each wind-speed and/or stability (or time-of-day) category for each season.

As shown by Equation (A-25), the rectangular concentration distribution within a given angular sector is modified by the function $S\{\theta\}$ which smoothes discontinuities in the concentration at the boundaries of adjacent sectors. The centerline concentration in each sector is unaffected by contributions from adjacent sectors. At points off the sector centerline, the concentration is weighted function of the concentration at the centerline of the sector in which the calculation is being made and the concentration at the centerline of the nearest adjoining sector.

The mean annual concentration at the point (r,θ) is calculated from the seasonal concentrations using the expression

$$\chi_a\{r,\theta\} = \frac{1}{4}\sum_{\ell=1}^{4} \chi_\ell\{r,\theta\} \tag{A-27}$$

A.4.2 Application of the Long-Term Model to Low-Level Emissions

Long-term ground-level concentrations produced by low-level emissions are calculated from Equation (A-23) by setting the buoyancy parameter F equal to zero. The standard deviation of the vertical concentration distribution at the downwind edge of the building σ_{zo} is defined as the building height divided by 2.15. Separate vertical turbulent intensities σ'_E may be defined for the low-level sources to account for the effects of surface heat sources and roughness elements. A virtual point source is used to account for the initial lateral dimension of the source in a manner identical to that described below for area sources.

A.4.3 Long-Term Concentration Model for Area Sources

The mean seasonal concentration at downwind distance r with respect to the center of an area source is given by the expression

$$\chi_\ell\{r > r_o\} = \frac{2\ K\ Q}{\sqrt{2\pi}\ R\ \Delta\theta'} \left\{ \sum_{i,j,k} \left[\frac{f_{i,j,k,\ell}}{\bar{u}_i\{h\}\ \sigma_{z;i,k}} \quad S\{\theta\}\ \ V_{i,k,\ell} \right] \right. \tag{A-28}$$

$$\left. \exp\left[-\ \psi\left(r' - r_o\right)/\bar{u}_i\{h\}\right] \right\}$$

where

R = radial distance from the virtual point source to the receptor

$= \left(\left(r' + x_y\right)^2 + \ y^2\right)^{1/2}$

r' = distance from source center to receptor, measured along the sector centerline (m)

r_o = effective source radius (m)

y = lateral distance from the sector centerline to the receptor (m)

x_y = lateral virtual distance (m)

$$= r_o \cot \frac{\Delta\theta'}{2} \qquad \text{(A-29)}$$

$$\sigma_{z;i,k} = \begin{cases} \dfrac{2\sigma'_{E;i,k}\ r_o}{\ln\left[\dfrac{\sigma'_{E;i,k}(r'+r_o)+h}{\sigma'_{E;i,k}(r'-r_o)+h}\right]} & ;\ r_o < r' < 6r_o \\[2ex] \sigma'_{E;i,k}r' + h & ;\ r' \geq 6r_o \end{cases} \qquad \text{(A-30)}$$

$$V_{i,k,\ell} = \begin{cases} 1+2\displaystyle\sum_{n=1}^{3} \exp\left[-\frac{1}{2}\left(\frac{2n\ H_{m;i,k,\ell}}{\sigma_{z;i,k}}\right)^2\right] & ;\ \dfrac{1}{2}\left(\dfrac{6H_{m;i,k,\ell}}{\sigma_{z;i,k}}\right)^2 \geq 10 \\[2ex] \dfrac{\sqrt{2\pi}\ \sigma_{z;i,k}}{H_{m;i,k,\ell}} & ;\ \dfrac{1}{2}\left(\dfrac{6H_{m;i,k,\ell}}{\sigma_{z;i,k}}\right)^2 < 10 \end{cases} \qquad \text{(A-31)}$$

and the remaining parameters are identical to those previously defined.

For points interior to the area source, the seasonal average concentration is given by the expression:

$$\chi_\ell\{r \leq r_o\} = \frac{2\ K\ Q}{\sqrt{2\pi}\ x_o\ y_o} \sum_{i,j,k} \left[\frac{f_{i,j,k,\ell}}{\bar{u}_i\{h\}\ \sigma'_{E;i,k}} \ln\left[\frac{\sigma'_{E;i,k}(r''+1)+h}{\sigma'_{E;i,k}+h}\right] V_{i,k,\ell}\right] \qquad \text{(A-32)}$$

where

r" = the downwind distance, measured along the sector centerline from the upwind edge of the area source (m)

A.5 APPLICATION OF THE SHORT-TERM AND LONG-TERM CONCENTRATION MODELS IN COMPLEX TERRAIN

The short-term and long-term concentration models described in Sections A.3 and A.4 are strictly applicable only for flat terrain where the base of the stack (or the building source) and the ground surface downwind from the source are at the same elevation. However, both models may also be applied to complex terrain by defining effective stabilization heights and mixing depths. The following assumptions are made in the model calculations for complex terrain:

- The top of the surface mixing layer extends over the calculation grid at a constant height above mean sea level
- Ground-level concentrations at all grid points above the top of the surface mixing layer are zero
- Plumes that stabilize above the top of the surface mixing layer do not contribute to ground-level concentrations at any grid point (this assumption also applies to flat terrain)

In order to determine whether the stabilized plume is contained within the surface mixing layer, it is necessary to calculate the mixing depth $H^*_m\{z_s\}$ at the source from the relationship

$$H^*_m\{z_s\} = \left(H_m + z_a - z_s\right) \qquad \text{(A-33)}$$

where

H_m = the depth of the surface mixing layer measured at a point with elevation z_a above mean sea level

z_s = the height above mean sea level of the source

Equation (A-33) is represented schematically in Figure A-1. As shown by the figure, the actual top of the surface mixing layer is assumed to remain at a constant elevation above mean sea level. If the height H of the stabilized plume above the base of the stack is less than or equal to $H_m^*\{z_s\}$, the plume is defined to be contained within the surface mixing layer.

The height H_o of the stabilized plume above mean sea level is given by the sum of the height H of the stabilized plume above the base of the stack and the elevation z_s of the base of the stack. At any elevation z above mean sea level, the effective height $H'\{z\}$ of the plume centerline above the terrain is then given by

$$H'\{z\} = \begin{cases} H_o - z \ ; & H_o - z \geq 0 \\ 0 \ ; & H_o - z < 0 \end{cases} \qquad \text{(A-34)}$$

The effective mixing depth $H_m'\{z\}$ above a point at elevation z above mean sea level is defined by

$$H_m'\{z\} = \begin{cases} H_m \ ; & z \geq z_a \\ H_m + z_a - z \ ; & z < z_a \end{cases} \qquad \text{(A-35)}$$

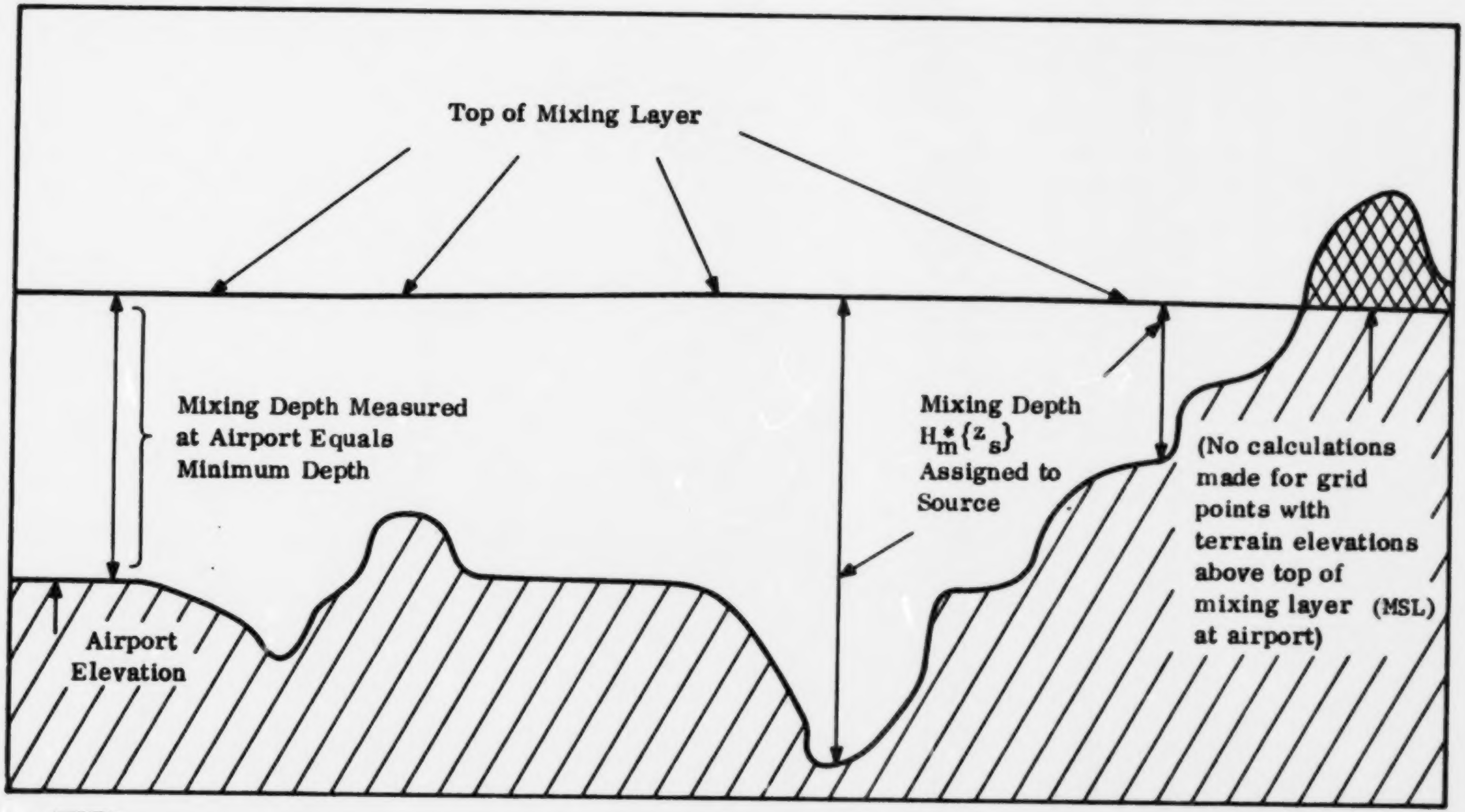
Top of Mixing Layer
Mixing Depth Measured at Airport Equals Minimum Depth
Airport Elevation
Mixing Depth $H_m^*\{z_s\}$ Assigned to Source
(No calculations made for grid points with terrain elevations above top of mixing layer (MSL) at airport)

FIGURE A-1. Mixing depth $H_m^*\{z_s\}$ used to determine whether the stabilized plume is contained within the surface mising layer.

Figure A-2 illustrates the assumptions implicit in Equation (A-35). For grid points at elevations below the airport elevation, the effective mixing depth $H'_m\{z\}$ is allowed to increase in a manner consistent with Figure A-1. However, in order to prevent a physically unrealistic compression of plumes as they pass over elevated terrain, the effective mixing depth is not permitted to be less than the mixing depth measured at the airport. It should be noted that the concentration is set equal to zero for grid points above the actual top of the mixing layer (see Figure A-1).

The terrain adjustment procedures also assume that the mean wind speed at any given height above sea level is constant. Thus, the wind speed $\bar{u}_R$ above the surface at a point with elevation z_a above mean sea level is adjusted to the stack height for the plume-rise calculations by the relationship

$$\bar{u}\{h\} = \begin{cases} \bar{u}_R \left(\dfrac{h_o - z_a}{z_R}\right)^p & ; \quad h_o \geq z_a + z_R \\ \\ \bar{u}_R & ; \quad h_o < z_a + z_R \end{cases} \qquad \text{(A-36)}$$

where h_o is the height above mean sea level of the top of the stack. Similarly, the wind speed $\bar{u}\{H\}$ used in the concentration calculations is given by

$$\bar{u}\{H\} = \begin{cases} \bar{u}_R \left(\dfrac{H_o - z_a}{z_R}\right)^p & ; \quad H_o \geq z_a + z_R \\ \\ \bar{u}_R & ; \quad H_o < z_a + z_R \end{cases} \qquad \text{(A-37)}$$

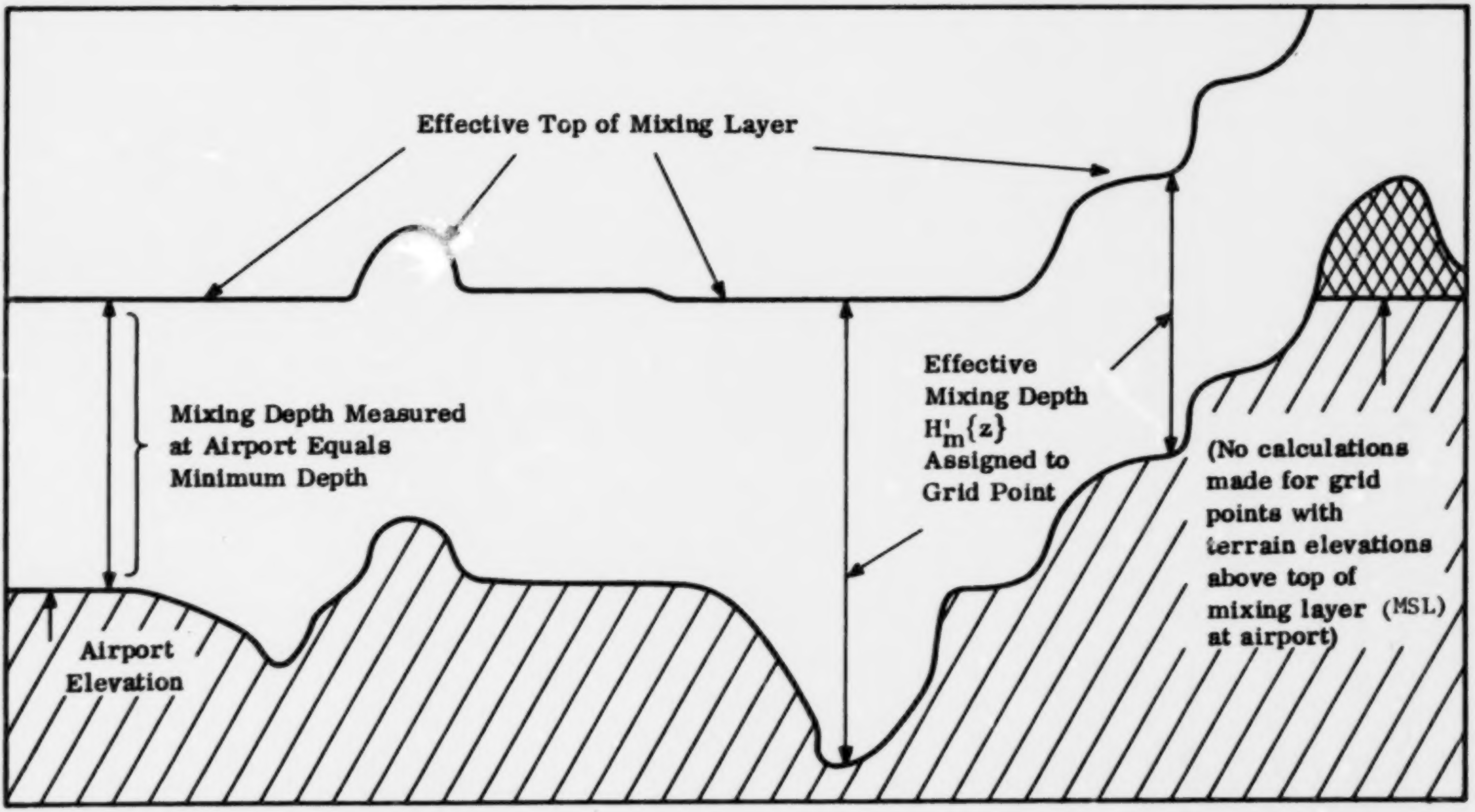
Effective Top of Mixing Layer
Mixing Depth Measured at Airport Equals Minimum Depth
Effective Mixing Depth $H'_m\{z\}$ Assigned to Grid Point
Airport Elevation
(No calculations made for grid points with terrain elevations above top of mixing layer (MSL) at airport)

FIGURE A-2. Effective mixing depth $H'_m\{z\}$assigned to grid points for the concentration calculations.

It should be noted that the terrain-adjustment procedures outlined above provide a very simple representation of complex plume-terrain interactions that are not yet well understood. Because the model assumptions are generally conservative, it is possible that concentrations calculated for elevated terrain, especially elevated terrain near a source, exceed the concentrations that actually occur. It should also be noted that the procedures described above differ from previous "terrain-intersection" models in that terrain intersection is only permitted for a plume contained within a mixing layer. That is, terrain intersection is permitted for all stability categories, but only for a plume contained within the surface mixing layer.

APPENDIX B

METEOROLOGICAL INPUTS USED IN THE LONG-TERM AND MODEL CALCULATIONS (BASED ON METEOROLOGICAL OBSERVATIONS MADE AT THE GREATER PITTSBURGH AIRPORT)

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APPENDIX B.1

1965 SEASONAL INPUTS USED FOR THE 1980 COMPLIANCE CALCULATIONS

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 1

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.9000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00038100	.00113940	.00034150	0.00000000	0.00000000	0.00000000
22.500	.00049480	.00125230	.00102460	0.00000000	0.00000000	0.00000000
45.000	.00072260	.00068310	.00011380	0.00000000	0.00000000	0.00000000
67.500	.00058080	.00091090	.00058310	0.00000000	0.00000000	0.00000000
90.000	.00096190	.00182150	.00125230	0.00000000	0.00000000	0.00000000
112.500	.00055060	.00170760	.00045540	0.00000000	0.00000000	0.00000000
135.000	.00046700	.00091080	.00011380	0.00000000	0.00000000	0.00000000
157.500	.00106170	.00193540	.00102460	0.00000000	0.00000000	0.00000000
180.000	.00090610	.00136610	.00148000	0.00000000	0.00000000	0.00000000
202.500	.00022540	.00102460	.00102460	0.00000000	0.00000000	0.00000000
225.000	.00062270	.00102450	.00079690	0.00000000	0.00000000	0.00000000
247.500	.00092000	.00170770	.00068310	0.00000000	0.00000000	0.00000000
270.000	.00063660	.00113840	.00125230	0.00000000	0.00000000	0.00000000
292.500	.00033920	.00079690	.00022770	0.00000000	0.00000000	0.00000000
315.000	.00035310	.00091070	.00091070	0.00000000	0.00000000	0.00000000
337.500	.00045310	.00079690	.00091070	0.00000000	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

```
                                                                 SEASON 1

                                                           STABILITY CATEGORY 2

                     WIND SPEED    WIND SPEED    WIND SPEED    WIND SPEED    WIND SPEED    WIND SPEED
                     CATEGORY 1    CATEGORY 2    CATEGORY 3    CATEGORY 4    CATEGORY 5    CATEGORY 6
  DIRECTION        (   .7500MPS)( 2.5000MPS)( 4.3000MPS)( 6.8000MPS)( 9.5000MFS)(12.5000MPS)
 (PHI DEGREES)
     0.000          .00014590     .00159380     .00387070     .00011380    0.00000000    0.00000000
    22.500          .00024930     .00136610     .00239070     .00011380    0.00000000    0.00000000
    45.000          .00012510     .00136610     .00182150    0.00000000    0.00000000    0.00000000
    67.500          .00010420     .00113840     .00341530    0.00000000    0.00000000    0.00000000
    90.000          .00040570     .00307380     .00352910    0.00000000    0.00000000    0.00000000
   112.500          .00066380     .00182150     .00352910     .00022770    0.00000000    0.00000000
   135.000          .00062290     .00273220     .00216300    0.00000000    0.00000000    0.00000000
   157.500          .00030140     .00193530     .00387070     .00011380    0.00000000    0.00000000
   180.000          .00100700     .00421220     .00626140     .00022770    0.00000000    0.00000000
   202.500          .00050830     .00148000     .00387070     .00045540    0.00000000    0.00000000
   225.000          .00043610     .00204920     .00478140     .00056920    0.00000000    0.00000000
   247.500          .00041530     .00182150     .00660290     .00034150     .00022770     .00011380
   270.000          .00022930     .00250460     .00650290     .00113840     .00022770     .00011380
   292.500          .00009380     .00102460     .00364300     .00022770     .00034150    0.00000000
   315.000          .00008340     .00091070     .00307380     .00068310    0.00000000    0.00000000
   337.500          .00007300     .00079690     .00318760     .00045540    0.00000000    0.00000000
```

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 3

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00102040	.00603370	.02311021	.01115661	.00056920	0.00000000
22.500	.00103130	.00387070	.01013211	.00261840	0.00000000	0.00000000
45.000	.00020010	.00398450	.00630290	.00113840	.00011380	0.00000000
67.500	.00031970	.00398450	.00774131	.00341530	.00079690	.00011380
90.000	.00067310	.00626140	.01035971	.00250460	.00011380	0.00000000
112.500	.00045640	.00432600	.01236431	.00273220	.00022770	0.00000000
135.000	.00077550	.00591990	.01423041	.00523690	.00011380	.00022770
157.500	.00074120	.00523680	.01149821	.00261840	.00022770	0.00000000
180.000	.00064510	.00808291	.02083331	.00660290	.00034150	0.00000000
202.500	.00014290	.00284610	.01423041	.00796901	.00056920	.00011380
225.000	.00030250	.00364300	.02060562	.02367942	.00569220	.00091070
247.500	.00099130	.00307380	.01707651	.02550092	.00762751	.00330150
270.000	.00076980	.00580600	.02459022	.03107922	.01070131	.00364300
292.500	.00024530	.00250460	.01377501	.01707651	.00466760	.00125230
315.000	.00067840	.00398450	.01741801	.01423041	.00409840	.00034150
337.500	.00022820	.00216300	.01650731	.01275051	.00136610	.00022770

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 4

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.9000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00265950	.00762751	.00590600	0.00000000	0.00000000	0.00000000
22.500	.00291300	.00774141	.00261840	0.00000000	0.00000000	0.00000000
45.000	.00451490	.00831060	.00227690	0.00000000	0.00000000	0.00000000
67.500	.00445440	.00762751	.00113840	0.00000000	0.00000000	0.00000000
90.000	.00922560	.01445811	.00136610	0.00000000	0.00000000	0.00000000
112.500	.00710580	.01468581	.00443590	0.00000000	0.00000000	0.00000000
135.000	.00798101	.01639351	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00551370	.00876600	.00227690	0.00000000	0.00000000	0.00000000
180.000	.01132441	.01605191	.00193530	0.00000000	0.00000000	0.00000000
202.500	.00410390	.00762751	.00387070	0.00000000	0.00000000	0.00000000
225.000	.00555440	.00956291	.00762751	0.00000000	0.00000000	0.00000000
247.500	.00477730	.00933521	.00614750	0.00000000	0.00000000	0.00000000
270.000	.00919010	.01331971	.00694440	0.00000000	0.00000000	0.00000000
292.500	.00511880	.00808291	.00193530	0.00000000	0.00000000	0.00000000
315.000	.00671990	.01070131	.00364300	0.00000000	0.00000000	0.00000000
337.500	.00230100	.00478140	.00409840	0.00000000	0.00000000	0.00000000

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES
(SIGEPU RADIANS)

```
                         WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                         CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00
STABILITY CATEGORY 2 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00
STABILITY CATEGORY 3 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01
STABILITY CATEGORY 4 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01
```

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES
(SIGEPL RADIANS)

```
                         WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                         CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00
STABILITY CATEGORY 2 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00
STABILITY CATEGORY 3 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01
STABILITY CATEGORY 4 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01
```

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VERTICAL POTENTIAL TEMPERATURE GRADIENT
(DPDZ DEGREES KELVIN)

```
                       WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                       CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00
STABILITY CATEGORY 2  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00
STABILITY CATEGORY 3  .150000E-01  .100000E-01  .500000E-02  .300000E-02  .300000E-02  .300000E-02
STABILITY CATEGORY 4  .300000E-01  .200000E-01  .150000E-01  .300000E-02  .300000E-02  .300000E-02
```

WIND PROFILE POWER LAW EXPONENT
(P)

```
                       WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                       CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1  .100000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 2  .200000E+00  .150000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 3  .250000E+00  .200000E+00  .150000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 4  .300000E+00  .250000E+00  .200000E+00  .200000E+00  .200000E+00  .200000E+00
```

AMBIENT AIR TEMPERATURE
(TA DEGREES KELVIN)

```
            STABILITY  STABILITY  STABILITY  STABILITY  STABILITY  STABILITY
            CATEGORY 1 CATEGORY 2 CATEGORY 3 CATEGORY 4 CATEGORY 5 CATEGORY 6
SEASON  1    286.9900   286.9900   283.9000   280.7800
```

MIXING LAYER DEPTH
(HM METERS)

```
                                                SEASON 1
                       WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                       CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1  .124750E+04  .128500E+04  .130000E+04  .130000E+04  .130000E+04  .130000E+04
STABILITY CATEGORY 2  .124750E+04  .128500E+04  .130000E+04  .130000E+04  .130000E+04  .130000E+04
STABILITY CATEGORY 3  .697500E+03  .788750E+03  .976250E+03  .130000E+04  .130000E+04  .130000E+04
STABILITY CATEGORY 4  .147500E+03  .292500E+03  .652500E+03  .115250E+04  .119125E+04  .119125E+04
                     *-* FREQUENCY OF OCCURRENCE OF WIND SPEED,DIRECTION AND STABILITY *-*
```

APPENDIX B.2

1976 SEASONAL METEOROLOGICAL INPUTS USED FOR MODEL VALIDATION CALCULATIONS

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 1

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00038100	.00113840	.00034150	0.00000000	0.00000000	0.00000000
22.500	.00049480	.00125230	.00102460	0.00000000	0.00000000	0.00000000
45.000	.00072260	.00068310	.00011380	0.00000000	0.00000000	0.00000000
67.500	.00058080	.00091080	.00068310	0.00000000	0.00000000	0.00000000
90.000	.00096190	.00182150	.00125230	0.00000000	0.00000000	0.00000000
112.500	.00055060	.00170760	.00045540	0.00000000	0.00000000	0.00000000
135.000	.00046700	.00091080	.00011380	0.00000000	0.00000000	0.00000000
157.500	.00106170	.00193540	.00102460	0.00000000	0.00000000	0.00000000
180.000	.00090610	.00136610	.00148000	0.00000000	0.00000000	0.00000000
202.500	.00022540	.00102460	.00102460	0.00000000	0.00000000	0.00000000
225.000	.00062270	.00102450	.00079690	0.00000000	0.00000000	0.00000000
247.500	.00092000	.00170770	.00068310	0.00000000	0.00000000	0.00000000
270.000	.00063660	.00113840	.00125230	0.00000000	0.00000000	0.00000000
292.500	.00033920	.00079690	.00022770	0.00000000	0.00000000	0.00000000
315.000	.00035310	.00091070	.00091070	0.00000000	0.00000000	0.00000000
337.500	.00045310	.00079690	.00091070	0.00000000	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 2

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00014590	.00159380	.00387070	.00011380	0.00000000	0.00000000
22.500	.00024930	.00136610	.00239070	.00011380	0.00000000	0.00000000
45.000	.00012510	.00136610	.00182150	0.00000000	0.00000000	0.00000000
67.500	.00010420	.00113840	.00341530	0.00000000	0.00000000	0.00000000
90.000	.00040570	.00307380	.00352910	0.00000000	0.00000000	0.00000000
112.500	.00066380	.00182150	.00352910	.00022770	0.00000000	0.00000000
135.000	.00062290	.00273220	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00030140	.00193530	.00387070	.00011380	0.00000000	0.00000000
180.000	.00100700	.00421220	.00626140	.00022770	0.00000000	0.00000000
202.500	.00050830	.00148000	.00387070	.00045540	0.00000000	0.00000000
225.000	.00043610	.00204920	.00478140	.00056920	0.00000000	0.00000000
247.500	.00041530	.00182150	.00660290	.00034150	.00022770	.00011380
270.000	.00022930	.00250460	.00660290	.00113840	.00022770	.00011380
292.500	.00009380	.00102460	.00364300	.00022770	.00034150	0.00000000
315.000	.00008340	.00091070	.00307380	.00068310	0.00000000	0.00000000
337.500	.00007300	.00079690	.00318760	.00045540	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 3

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00102040	.00603370	.02311021	.01115661	.00056920	0.00000000
22.500	.00103130	.00387070	.01013211	.00261840	0.00000000	0.00000000
45.000	.00020010	.00398450	.00660290	.00113840	.00011380	0.00000000
67.500	.00031970	.00398450	.00774131	.00341530	.00079690	.00011380
90.000	.00067310	.00626140	.01035971	.00250460	.00011380	0.00000000
112.500	.00045640	.00432600	.01286431	.00273220	.00022770	0.00000000
135.000	.00077550	.00591990	.01423041	.00523680	.00011380	.00022770
157.500	.00074120	.00523680	.01149821	.00261840	.00022770	0.00000000
180.000	.00064510	.00808291	.02083331	.00660290	.00034150	0.00000000
202.500	.00014290	.00284610	.01423041	.00796901	.00056920	.00011380
225.000	.00030250	.00364300	.02060562	.02367942	.00569220	.00091070
247.500	.00099130	.00307380	.01707651	.02550092	.00762751	.00330150
270.000	.00076980	.00580600	.02459022	.03107922	.01070131	.00364300
292.500	.00024530	.00250460	.01377501	.01707651	.00466760	.00125230
315.000	.00067840	.00398450	.01741801	.01423041	.00409840	.00034150
337.500	.00022820	.00216300	.01650731	.01275051	.00136610	.00022770

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 4

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00265950	.00762751	.00580600	0.00000000	0.00000000	0.00000000
22.500	.00291300	.00774141	.00261840	0.00000000	0.00000000	0.00000000
45.000	.00451490	.00831060	.00227690	0.00000000	0.00000000	0.00000000
67.500	.00445440	.00762751	.00113840	0.00000000	0.00000000	0.00000000
90.000	.00822560	.01445811	.00136610	0.00000000	0.00000000	0.00000000
112.500	.00710580	.01468581	.00443990	0.00000000	0.00000000	0.00000000
135.000	.00798101	.01639351	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00551370	.00876600	.00227690	0.00000000	0.00000000	0.00000000
180.000	.01132441	.01605191	.00193530	0.00000000	0.00000000	0.00000000
202.500	.00410390	.00762751	.00387070	0.00000000	0.00000000	0.00000000
225.000	.00585440	.00956291	.00762751	0.00000000	0.00000000	0.00000000
247.500	.00477730	.00933521	.00614750	0.00000000	0.00000000	0.00000000
270.000	.00819010	.01331971	.00694440	0.00000000	0.00000000	0.00000000
292.500	.00511880	.00808291	.00193530	0.00000000	0.00000000	0.00000000
315.000	.00671990	.01070131	.00364300	0.00000000	0.00000000	0.00000000
337.500	.00230100	.00478140	.00409840	0.00000000	0.00000000	0.00000000

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES
(SIGEPU RADIANS)

```
                       WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                       CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00
STABILITY CATEGORY 2 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00
STABILITY CATEGORY 3 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01
STABILITY CATEGORY 4 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01
```

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES
(SIGEPL RADIANS)

```
                       WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                       CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00
STABILITY CATEGORY 2 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00
STABILITY CATEGORY 3 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01
STABILITY CATEGORY 4 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01
```

VERTICAL POTENTIAL TEMPERATURE-GRADIENT
(DPDZ DEGREES KELVIN)

```
                      WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                      CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1 .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00
STABILITY CATEGORY 2 .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00
STABILITY CATEGORY 3 .150000E-01  .100000E-01  .500000E-02  .300000E-02  .300000E-02  .300000E-02
STABILITY CATEGORY 4 .300000E-01  .200000E-01  .150000E-01  .300000E-02  .300000E-02  .300000E-02
```

WIND PROFILE POWER LAW EXPONENT
(P)

```
                      WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                      CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1 .100000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 2 .200000E+00  .150000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 3 .250000E+00  .200000E+00  .150000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 4 .300000E+00  .250000E+00  .200000E+00  .200000E+00  .200000E+00  .200000E+00
```

AMBIENT AIR TEMPERATURE
(TA DEGREES KELVIN)

```
               STABILITY  STABILITY  STABILITY  STABILITY  STABILITY  STABILITY
               CATEGORY 1 CATEGORY 2 CATEGORY 3 CATEGORY 4 CATEGORY 5 CATEGORY 6
SEASON   1       286.9900   286.9900   283.9000   280.7800
```

MIXING LAYER DEPTH
(HM METERS)

```
                                                 SEASON 1
                        WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                        CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1  .124750E+04  .128500E+04  .130000E+04  .130000E+04  .130000E+04  .130000E+04
STABILITY CATEGORY 2  .124750E+04  .128500E+04  .130000E+04  .130000E+04  .130000E+04  .130000E+04
STABILITY CATEGORY 3  .697500E+03  .788750E+03  .976250E+03  .115250E+04  .130000E+04  .130000E+04
STABILITY CATEGORY 4  .147500E+03  .292500E+03  .652500E+03  .652500E+03  .652500E+03  .652500E+03
```

APPENDIX B.3

1977 SEASONAL METEOROLOGICAL INPUTS USED FOR MODEL VALIDATION CALCULATIONS

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 1

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00067210	.00228310	.00159820	0.00000000	0.00000000	0.00000000
22.500	.00051470	.00102740	.00079910	0.00000000	0.00000000	0.00000000
45.000	.00061480	.00182650	.00079910	0.00000000	0.00000000	0.00000000
67.500	.00157220	.00125570	.00034250	0.00000000	0.00000000	0.00000000
90.000	.00186110	.00148400	.00011420	0.00000000	0.00000000	0.00000000
112.500	.00127170	.00091330	.00034250	0.00000000	0.00000000	0.00000000
135.000	.00109240	.00148410	.00034250	0.00000000	0.00000000	0.00000000
157.500	.00177950	.00182650	.00057080	0.00000000	0.00000000	0.00000000
180.000	.00251310	.00353880	.00285390	0.00000000	0.00000000	0.00000000
202.500	.00146340	.00239730	.00114160	0.00000000	0.00000000	0.00000000
225.000	.00063260	.00194070	.00079910	0.00000000	0.00000000	0.00000000
247.500	.00068620	.00136980	.00102740	0.00000000	0.00000000	0.00000000
270.000	.00021960	.00171240	.00068490	0.00000000	0.00000000	0.00000000
292.500	.00051150	.00102740	.00068490	0.00000000	0.00000000	0.00000000
315.000	.00011790	.00091320	.00102740	0.00000000	0.00000000	0.00000000
337.500	.00034470	.00068500	.00079910	0.00000000	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 2

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00062790	.00159820	.00525110	.00034250	0.00000000	0.00000000
22.500	.00029490	.00057080	.00068490	0.00000000	0.00000000	0.00000000
45.000	.00037100	.00148400	.00091320	0.00000000	0.00000000	0.00000000
67.500	.00020930	.00102740	.00114160	0.00000000	0.00000000	0.00000000
90.000	.00094180	.00239730	.00148400	0.00000000	0.00000000	0.00000000
112.500	.00033300	.00102740	.00034250	0.00000000	0.00000000	0.00000000
135.000	.00126520	.00182650	.00045660	0.00000000	0.00000000	0.00000000
157.500	.00096080	.00262560	.00228310	0.00000000	0.00000000	0.00000000
180.000	.00135080	.00433790	.00536530	0.00000000	0.00000000	0.00000000
202.500	.00080860	.00228310	.00399540	.00011420	0.00000000	0.00000000
225.000	.00046610	.00262560	.00479450	.00022830	0.00000000	0.00000000
247.500	.00030440	.00216890	.00730590	.00057080	.00022830	0.00000000
270.000	.00025680	.00159820	.00696350	.00136990	.00011420	0.00000000
292.500	.00085620	.00136990	.00296800	.00079910	0.00000000	0.00000000
315.000	.00010460	.00125570	.00353880	.00022830	0.00000000	0.00000000
337.500	.00043760	.00079910	.00296800	.00022830	.00011420	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 3

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00131280	.00605020	.01244290	.00502280	.00068490	0.00000000
22.500	.00082250	.00171230	.00331050	.00045660	0.00000000	0.00000000
45.000	.00150830	.00525110	.00502280	.00022830	0.00000000	0.00000000
67.500	.00138390	.00308220	.00593610	.00057080	0.00000000	0.00000000
90.000	.00118550	.00593610	.01175800	.00182650	0.00000000	0.00000000
112.500	.00102830	.00319630	.00890410	.00285390	0.00000000	0.00000000
135.000	.00257880	.00707760	.01563930	.00547950	.00022830	.00022830
157.500	.00111070	.00673520	.01221460	.00285390	.00011420	0.00000000
180.000	.00340220	.01301370	.02180370	.00650680	.00034250	.00011420
202.500	.00125760	.00719180	.01541100	.00719180	.00068490	0.00000000
225.000	.00253670	.00844750	.02534250	.02020551	.00285390	.00011420
247.500	.00152520	.00764840	.02808220	.03196350	.00924660	.00182650
270.000	.00148960	.00913240	.03196350	.03915530	.01221460	.00468040
292.500	.00147560	.00468040	.01803650	.01575340	.00433790	.00057080
315.000	.00121730	.00228310	.01438360	.01609590	.00273970	.00114160
337.500	.00036590	.00216890	.01347030	.00970320	.00079910	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 4

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00722410	.00833340	.00684930	0.00000000	0.00000000	0.00000000
22.500	.00438180	.00673520	.00091320	0.00000000	0.00000000	0.00000000
45.000	.00403670	.00502280	.00068490	0.00000000	0.00000000	0.00000000
67.500	.00332110	.00639270	.00091320	0.00000000	0.00000000	0.00000000
90.000	.00707400	.00890410	.00125570	0.00000000	0.00000000	0.00000000
112.500	.00282850	.00331050	.00114160	0.00000000	0.00000000	0.00000000
135.000	.00905900	.00821920	.00216890	0.00000000	0.00000000	0.00000000
157.500	.00742750	.00958910	.00045660	0.00000000	0.00000000	0.00000000
180.000	.01310940	.01906390	.00125570	0.00000000	0.00000000	0.00000000
202.500	.00386120	.00867580	.00148400	0.00000000	0.00000000	0.00000000
225.000	.00387230	.00878990	.00308220	0.00000000	0.00000000	0.00000000
247.500	.00636950	.00936080	.00468040	0.00000000	0.00000000	0.00000000
270.000	.00982110	.01780820	.00707760	0.00000000	0.00000000	0.00000000
292.500	.00673410	.00764840	.00228310	0.00000000	0.00000000	0.00000000
315.000	.00540340	.00787670	.00525110	0.00000000	0.00000000	0.00000000
337.500	.00148090	.00479450	.00479450	0.00000000	0.00000000	0.00000000

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES
(SIGEPU RADIANS)

```
                      WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                      CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00
STABILITY CATEGORY 2 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00
STABILITY CATEGORY 3 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01
STABILITY CATEGORY 4 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01
```

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES
(SIGEPL RADIANS)

```
                      WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                      CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00 .174500E+00
STABILITY CATEGORY 2 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00 .108000E+00
STABILITY CATEGORY 3 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01 .735000E-01
STABILITY CATEGORY 4 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01 .465000E-01
```

VERTICAL POTENTIAL TEMPERATURE GRADIENT
(DPDZ DEGREES KELVIN)

```
                      WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                      CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1 .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00
STABILITY CATEGORY 2 .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00  .000000E+00
STABILITY CATEGORY 3 .150000E-01  .100000E-01  .500000E-02  .300000E-02  .300000E-02  .300000E-02
STABILITY CATEGORY 4 .300000E-01  .200000E-01  .150000E-01  .300000E-02  .300000E-02  .300000E-02
```

WIND PROFILE POWER LAW EXPONENT
(P)

```
                      WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED   WIND SPEED
                      CATEGORY 1   CATEGORY 2   CATEGORY 3   CATEGORY 4   CATEGORY 5   CATEGORY 6
STABILITY CATEGORY 1 .100000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 2 .200000E+00  .150000E+00  .100000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 3 .250000E+00  .200000E+00  .150000E+00  .100000E+00  .100000E+00  .100000E+00
STABILITY CATEGORY 4 .300000E+00  .250000E+00  .200000E+00  .200000E+00  .200000E+00  .200000E+00
```

AMBIENT AIR TEMPERATURE
(TA DEGREES KELVIN)

```
           STABILITY  STABILITY  STABILITY  STABILITY  STABILITY  STABILITY
           CATEGORY 1 CATEGORY 2 CATEGORY 3 CATEGORY 4 CATEGORY 5 CATEGORY 6
SEASON  1   286.9900   286.9900   283.9000   280.7800
```

MIXING LAYER DEPTH
(HM METERS)

```
                                             SEASON 1
                         WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                         CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 1 .124750E+04 .128500E+04 .130000E+04 .130000E+04 .130000E+04 .130000E+04
STABILITY CATEGORY 2 .124750E+04 .128500E+04 .130000E+04 .130000E+04 .130000E+04 .130000E+04
STABILITY CATEGORY 3 .697500E+03 .788750E+03 .976250E+03 .115250E+04 .119125E+04 .119125E+04
STABILITY CATEGORY 4 .147500E+03 .292500E+03 .652500E+03 .652500E+03 .652500E+03 .652500E+03
```

APPENDIX C

SO_2 EMISSIONS INVENTORIES

APPENDIX C.1

```
    SWPA AQCR ANNUAL COMPLIANCE EMISSIONS INVENTORY

SOURCE  SOURCE STRENGTH G/S            UTM          HT    ELE  TEMP. VOL.   R
  NO.   ANNUAL SEA 2 SEA 3 SEA 4      X     Y     (M)    (M)   K    M/S3  (M)

     ALLEGHENY COUNTY SOURCES AS SUPPLIED BY ACBAPC/TRC
     RECEIVED FROM REGION III:  07 SEPTEMBER 1979

 PITTSBURGH BREWING
   1    11.10                      5875504479280  58.0   226   488  16.9 1.60
 KOPPERS
   2     2.44                      5744004468100  28.6   250   533  34.1  .62
   3     2.44                      5744004468100  28.6   250   637  18.4  .76
 12TH STREET STEAM PLANT
   4    19.20                      5852004477600  82.0   221   604 265.5 2.20
 WEST PENN. POWER SPRINGDALE
   5    10.80                      6043804488740  64.3   227   472 185.5 2.44
   6    10.80                      6043804488740  64.3   227   444 192.7 1.85
 DUQUESNE LIGHT CHESWICK
   7  1306.30                      6023304487800 229.0   229   5581024.6 3.20
 SATELLITE ALLOY
  81     5.78                      6042004488500  10.0   229   100   100
 EDGE STEEL
   9      .80                      5976004485200  38.1   220   348  21.8  .76
 DUQUESNE LIGHT BRUNOT ISLAND TURBINES
  10    19.30                      5806804479680  10.0   222   735 248.6 2.06
  11    53.30                      5806804479680  19.2   222   467 333.7 1.91
 MARQUET CEMENT
  12    47.80                      5783004482600  46.0   222   491  94.0 1.90
 SHENANGO BATTERIES #2,#3
  13     2.40                      5780504483110  76.0   222   588 106.0 1.05
```

```
SHENANGO BATTERIES #4
 14      1.90                   5779404483200  69.0   222   478  62.0 1.05
SHENANGO BOILER #7,#8
 15     11.40                   5783304482800  26.0   222   452  38.0  .90
SHENANGO BOILER #9
 16      3.20                   5783604482790  38.7   222   627 155.0 1.50
VULCAN MATERIALS
 17      3.00                   5748004484600  20.3   223   553  10.2  .50
 18      2.00                   5748004484600  17.2   223   553   2.4  .50
PITTSBURGH ACTIVATED CARBON
 19      2.15                   5781004482500  12.2   223   533    .7  .20
 20      2.80                   5781004482500  18.9   223  1255   5.3  .38
 21      1.30                   5781004482500  17.8   223  1144  25.0  .52
ALCOSAN
 22      8.40                   5814004480800  91.4   230   344  23.5 1.22
DUQUESNE LIGHT PHILLIPS POWER STATION
 23    266.10                   5652604491020 104.0   226   322 340.4 3.96
DRAVCO
 70      7.20                   5786004482600  25.6   226   416  20.7  .75
USS CHEMICAL NEVEL ISLAND
 71      2.20                   5780004483000  30.5   223   322   5.6  .30
 72      4.50                   5779004483700  12.2   223   541  18.8  .60
NEVEL CHEMICALS
 73      3.00                   5764004483700  12.0   223   573   8.0  .61
 74      3.50                   5764004483700  14.0   223   543   6.8  .61
BLAWNOX
 75      2.50                   5878004480400  22.3   223   352  14.6  .55
 76      2.20                   5878004480400  22.3   223   352  10.7  .55
 77      1.90                   5878004480400  22.3   223   352   9.9  .55
HAHN
 78      2.90                   5862004484900  47.2   329   394  10.8  .60
BLTZHVR
 79       .10                   5848004474400  18.3   305   408   1.0  .50
PERRY
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 80       .90                     5831004482300  18.3   354   408  10.3  .50
OVERBROOK
 81       .10                     5851004471200  18.3   280   408    .9  .50
SOUTH HILLS
 82       .60                     5844004475000  18.3   335   408   7.5  .50
21ST STREET STEAM
 83    19.20                      5864004478100  18.3   268   408    .8  .50
MORSE
 84       .10                     5874004475500  18.3   229   408   1.0  .50
LATIMER
 85       .60                     5846004478700  18.3   244   408   3.7  .50
MCKEYSPORT HOSPITAL
 86       .50                     5990004466600  27.4   274   408   5.4  .70
 87       .10                     5965004466900  18.3   238   408   1.2  .50
ST. JOSEPH'S HOSPITAL
 88       .70                     5816004480900  40.0   238   408   3.9  .55
PPG
 89       .60                     6044004494200  73.2   274   514  18.7 1.85
 90       .50                     6044004494200  39.2   274   514  10.1  .90
GLASSMERE
 91       .10                     6036004492500  15.2   229   644   6.2  .60
DUQUESNE LIGHT MANSFIELD
 92       .30                     5821004478900  12.2   232  1033   3.9  .45
SHENANGO BLAST AREA
 941      .50                     5782204482970  10.0   222   100   100
SHENANGO BOILER #10
 95     2.29                      5783904482780  33.5   222   477142.79 1.50
SHENANGO BATTERY #2 AREA
 961    5.56                      5780504483120  10.0   222   100   100
SHENANGO BATTERY #3 AREA
 971    5.56                      5779804483160  10.0   222   100   100
SHENANGO BATTERY #4 AREA
 981    8.75                      5779504483210  10.0   222   100   100
SHENANGO MISCELLANEOUS AREA
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 991      .02                     5779604483160  10.0   222   100   100
SHENANGO D/S PLANT
100      8.75                     5780604482940  34.3   222   976   1.0  .22

USS CLAIRTON

BATTERY #1
110      2.31                     5958954461555  69.0   229   588  37.4 1.22
BATTERY #2
111      2.31                     5958804461565  69.0   229   588  37.4 1.22
BATTERY #3
112      2.31                     5957454461715  69.0   229   588  37.4 1.22
BATTERY #7
113      2.31                     5959304461590  65.0   229   575  35.6 1.27
BATTERY #8
114      2.31                     5959304461590  65.0   229   575  35.6 1.27
BATTERY #9
115      2.31                     5959304461590  65.0   229   575  35.6 1.27
BATTERY #13
120      2.22                     5953604461925  61.0   229   575  45.9 1.50
BATTERY #14
121      2.22                     5953504461935  61.0   229   575  45.9 1.50
BATTERY #15
122      2.22                     5952154462105  61.0   229   575  45.9 1.50
BATTERY #19
125      3.90                     5952254461875  76.0   229   577  50.4 2.14
BATTERY #20
126      3.90                     5952104461895  76.0   229   577  50.4 2.14
BATTERY #21
127      3.90                     5951104462140  76.0   229   575  51.5 2.14
BATTERY #22
128      3.90                     5949954462160  76.0   229   575  51.5 2.14
TAIL GAS
129      2.33                     5957154461695  46.0   223   561  18.0  .61
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REHEAT MILLS
130      1.35      5958714461000  18.0   224   811   70.0   .70
131      1.35      5958674460980  18.0   224   811   70.0   .70
132       .52      5960094460924  30.5   224   811   70.0   .60
133       .52      5959964460929  30.5   224   811   70.0   .60
134       .52      5959824460933  30.5   224   811   70.0   .60
135       .52      5959694460930  30.5   224   811   70.0   .60
136       .37      5958334461020  25.9   226   811   11.8   .65
137       .37      5958274461004  25.9   226   811   11.8   .65
138       .37      5958224460991  25.9   226   811   11.8   .65
BOILER #1
141     50.60      5949584462545  50.0   226   478   91.7 1.33
BOILER #2
142     34.50      5949334462564  50.0   226   478   80.4 1.06
BOILER #13
143     16.40      5947604462427  27.0   226   613   62.3 1.14
BOILER #14
144     16.40      5947894462402  27.0   226   613   62.3 1.14
BOILER R1,R2
145     18.36      5948004462400  50.0   227   444   48.8 1.52

USS DUQUESNE

SOAKING PITS
146     28.07      5981874470077  54.9   229   600   23.9 1.20
147     28.07      5982104470053  54.9   229   600   23.9 1.20
148     28.07      5982324470025  54.9   229   600   23.9 1.20
149     28.07      5982554469998  54.9   229   600   23.9 1.20
HEAT TREATING
'1501    7.42      5978834470353  10.0   229   100    100
REHEAT FURNACE
151      1.55      5978974470169   8.0   229   811   12.5   .62
152      1.55      5979044470162   8.0   229   811   12.5   .62
153      2.68      5978574470162  37.0   229   589    8.8   .90
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154      2.68                    5978734470143  37.0   229   589    8.8  .90
155      2.68                    5978844470129  37.0   229   589    8.8  .90
BOILER #15
157      1.20                    5985624469030  49.0   229   478   33.4 1.15
BOILER #17
158      1.20                    5985434469062  49.0   229   478   33.4 1.15

USS NATIONAL

SINTER PLANT
159      0.00                    5977204467400  27.4   229   330    3.4  .94
SOAKING PITS
160      1.21                    5976804467485  27.0   229   616    4.9  .62
161      1.21                    5976904467490  27.0   229   616    4.9  .62
162      1.21                    5977104467492  27.0   229   616    4.9  .62
163      1.21                    5977154467493  27.0   229   616    4.9  .62
164      1.21                    5977304467494  27.0   229   616    4.9  .62
165      1.21                    5977454467495  27.0   229   616    4.9  .62
166      1.26                    5977604467497  27.0   229   616    5.9  .62
167      1.26                    5977704467498  27.0   229   616    5.9  .62
168      1.26                    5977854467499  27.0   229   616    5.9  .62
169      1.26                    5977974467500  27.0   229   616    5.9  .62
ROTARY
170     20.90                    5967444467549  38.0   229  1089   98.5  .88
HEAT FURNACE
171      7.53                    5966664467575  38.0   229   533   30.6  .76
172      7.53                    5966684467563  38.0   229   533   30.6  .76
REHEAT FURNACE
173      1.71                    5967814467574  38.0   229   533    7.4  .68
174      1.71                    5967994467578  38.0   229   533    7.4  .68
175      1.71                    5969324467442  38.0   229   533    7.4  .68
NORMALIZER
176      2.25                    5969254467478  14.0   229   533    1.0  .25
177       .64                    5970754467532  14.0   229   477   16.9  .65
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WALKING FURNACE
178      1.71                5967044467557  38.5   229   532   5.6  .68
WARM FURNACE
1791     3.26                5972404467600  10.0   229   100   100
BOILER #1
180     16.90                5972154467595  44.7   221   635 101.5 1.34
BOILER #2
181     16.90                5972154467580  44.7   221   635 101.5 1.34
BOILER #3
182     16.90                5972254467580  44.7   221   635 101.5 1.34
BOILER #4
183     16.90                5972254467595  44.7   221   635 101.5 1.34
BOILER #5
184     16.90                5974004467330  44.7   221   635 101.5 1.34

USS IRVIN

SLAB HEATING
185     16.80                5931454465680  21.3   283   450  46.7 1.30
186     16.80                5931504465628  21.3   283   450  46.7 1.30
187     16.80                5931554465693  21.3   283   450  46.7 1.30
188     16.80                5931574465710  21.3   283   450  46.7 1.30
189     21.80                5931564465725  21.3   283   450  46.7 1.50
BOILERS #3,#4
190     14.40                5932134465750  32.0   283   643 109.0 1.52
BOILERS #5,#6
191     17.90                5932194465765  32.0   283   643 115.6 1.52
BOILER #7
192      9.80                5932104465712  26.5   283   455  42.5  .91

USS CLAIRTON

BATTERY B
193      6.38                5956804461900  83.8   229   575 80.01 2.74
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BATTERY C
194      6.38                    5955004462100  83.8   229   575  80.01 2.74
BOILERS T1 & T2
195     23.28                    5947704462400  26.5   226   444  20.93  .73

USS NATIONAL

TEMPERING
1961     0.00                    5967044467557  10.0   229   100   100
DUQUESNE LIGHT STANWICK
201     17.10                    5843804477300  97.5   220   574  217.2 2.40
H J HEINZ
202     11.90                    5860004478900  76.0   222   464   70.3 1.50
203     19.80                    5860004478900  76.0   222   464  103.1 1.50
WESTINGHOUSE ELECTRIC
204      4.00                    5990204472550  37.1   308   466   23.4  .99
BELLEFIELD BOILERS
205     21.10                    5891904477100  59.4   256   589   49.6 1.40
206     22.40                    5891904477100  77.7   256   517   91.9 1.70
WABCO
207      4.70                    5944004475550  27.0   274   569   19.3  .70
MESTA MACHINE
208       .10                    5909204471980  61.0   229   393   18.8  .90
B&O RAILROAD
209      3.30                    5898004472500  38.0   230   533   99.6 1.06
UNIVERSAL ATLAS
210     63.80                    6003004479400  16.7   371   513  202.5 1.10

USS HOMESTEAD

OPEN HEARTH
211     21.50                    5924504473650  37.0   229   533   94.0 1.98
212     21.50                    5924754473685  37.0   229   533   94.0 1.98
213     21.50                    5925104473750  37.0   229   533   94.0 1.98
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214    21.50                  5925204473760  37.0   229   533   94.0 1.98
215    21.50                  5925504473820  37.0   229   533   94.0 1.98
SOAKING PITS
216     1.43                  5918954473025  37.0   229   533    6.5  .84
217     1.43                  5919004473035  37.0   229   533    6.5  .84
218     1.43                  5919034473045  37.0   229   533    6.5  .84
219     1.43                  5919054473050  37.0   229   533    6.5  .84
220     2.20                  5919104473060  31.0   229   533   10.0  .76
221     2.20                  5919134473070  31.0   229   533   10.0  .76
222     2.20                  5919154473080  31.0   229   533   10.0  .76
223     2.20                  5919204473090  31.0   229   533   10.0  .76
224     2.20                  5919254473100  31.0   229   533   10.0  .76
225     2.20                  5919304473110  31.0   229   533   10.0  .76
226     2.20                  5919354473120  31.0   229   533   10.0  .76
227     2.20                  5919404473130  31.0   229   533   10.0  .76
228     2.20                  5919504473140  31.0   229   533   10.0  .76
229     2.20                  5919604473150  31.0   229   533   10.0  .76
230     2.20                  5919654473160  31.0   229   533   10.0  .76
231     2.20                  5919704473170  31.0   229   533   10.0  .76
232     2.26                  5919754473180  44.0   229   533    7.5 1.05
233    13.73                  5931084473742  50.0   230   533  117.2  .84
234    11.70                  5930924473742  50.0   230   533  117.2  .84
36" MILL
235     2.18                  5932254473733  23.0   230   477   28.5  .40
236     1.84                  5932254473755  35.0   230   477    8.8  .76
BLACKSMITH
237     1.16                  5934254474000  23.0   227   477   12.0  .38
100" MILL
238    26.82                  5918874473270  38.0   227   477   17.2  .80

NORMALIZER
2391     .35                  5918874473270  10.0   229   100   100
PREHEAT HOODS
2401    8.24                  5923804473606  10.0   229   100   100
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160" REHEAT FURNACE
241      7.71                  5919754473450  70.0   227   477   25.9 1.52
160" IN-OUT FURNACE
242      3.44                  5919584473250  31.0   227   477    7.0  .68
243      1.66                  5919504473450  31.0   227   477    3.4  .68
#2 FORGE
244      3.71                  5927334473833  30.0   229   477    6.8  .91
245      1.05                  5927334473833  30.0   229   477    3.4  .38
246       .84                  5927334473833  24.0   229   477    2.8  .38
247       .84                  5927334473833  24.0   229   477    5.5  .91
248      4.78                  5927334473833  24.0   229   477    9.5  .99
249      1.25                  5927334473833  18.0   229   477    1.5  .38
250      3.96                  5927334473833  29.0   229   477   10.1  .99
HARVEY FORGE
251      2.89                  5932254473893  24.0   229   477    1.0  .68
252       .69                  5932254473893  25.0   229   477    1.7  .68
253      2.07                  5932254473893  24.0   229   477    1.7  .68
254       .66                  5932254473893  24.0   229   477    1.4  .68
48" MILL
255      1.18                  5938654473555  32.0   229   477    3.4  .68
BOILER #3
256     54.90                  5942924474640  44.7   222   588  270.4 1.75
BOILER #4
257     44.30                  5942834474750  44.7   222   588  167.9 1.25

USS EDGAR THOMSON

SOAKING PITS
258     17.99                  5974404471870  30.0   233   533   42.1  .88
RILEY BOILER #1
259     27.37                  5970834471740  50.0   221   616   69.6 1.91
RILEY BOILER #2
260     27.37                  5972604471685  50.0   221   616   69.6 1.91
RILEY BOILER #3
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261    27.37                 5972764471673  50.0   221   616  69.6 1.91

J&L PITTSBURGH

KEELER BOILER
262      1.75                5892604473890  24.4   235   405   9.3  .66
RILEY BOILER
263      5.95                5892604473890  21.7   235   566  13.2  .98
SOUTHSIDE BOILERS
264     58.90                5880004475340  36.0   225   461  38.7 1.22
10" MILL
266      1.47                5892804474080  38.1   238  1089  25.5 1.06
14" MILL
267      5.96                5893004474120  38.1   238  1089   8.9  .84
COKE BATTERIES
268      5.20                5891304474010  61.0   235   634  54.7 1.30
269      5.20                5891604473900  61.0   235   634  54.7 1.30
270      3.68                5892604473760  69.0   235   533  50.9 1.45
SOAKING PITS "D"
281      4.02                5877804475520  46.0   226   811  18.7  .95
282       .75                5877804475520  46.0   226   700   7.0  .95

USS HOMESTEAD

PACKAGE BOILERS #1-3
283      8.67                5925754473900  15.0   226   561 25.74 1.60

USS EDGAR THOMSON

B&W BOILERS
284      0.00                5972724471676  33.0   221   551 26.19 1.20

J&L PITTSBURGH
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SLAB HEAT FURNACE
285      0.68                  5883004475790  22.7   235   839 22.34 1.30
TAIL GAS
286     21.20                  5891804474100  30.5   235   350  5.31  .17
ELECTRIC FURNACE
2871     0.80                  5881004475140  10.0   235   100  100.
MISCELLANEOUS AREA
2881     0.17                  5891004473900  10.0   235   100  100.

USS DUQUESNE

 BOILER #6
290       0.74                 5985504469010  49.0   229   560 72.03 1.15
 BOILER #7
291       0.74                 5985704469010  49.0   229   560 72.03 1.15
 BOILER #8
292       0.74                 5985504469020  49.0   229   560 72.03 1.15
 BOILER #9
293       0.74                 5985604469020  49.0   229   560 72.03 1.15
 BOILER #10
294       0.74                 5985404469030  49.0   229   560 72.03 1.15
 BOILER #11
295       0.74                 5985604469039  49.0   229   560 72.03 1.15
 BOILER #12
296       0.67                 5985504469040  49.0   229   476 67.1  1.15
 BOILER #13
297       0.67                 5985604469040  49.0   229   476 67.1  1.15
 BOILER #14
298       0.67                 5985404469050  49.0   229   476 67.1  1.15
 BOILER #16
299       0.67                 5985404469060  49.0   229   476 67.1  1.15
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MONONGAHELA VALLEY SOURCES

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ARMCO STEEL
417     7.45                      5652834495355  24.0   233   589 62.40   .91
DUQUESNE LIGHT ELRANA
420   326.80                      5920004456200 119.0   229   333867.90 3.96
WEST PENN. POWER MITCHELL
426    30.00                      5873404452810  59.0   232   464113.30 2.13
429    30.60                      5873404452810  59.0   232   464113.30 2.13
430    25.20                      5873404452810  59.0   232   464113.30 2.13
431   201.50                      5873404452810 107.0   232   422519.20 3.05
WHEELING-PITTSBURGH STEEL MONESSEN
432     1.60                      5939144446100  31.0   230   505  3.84   .61
435     4.80                      5939144446100  38.0   230   666  7.00   .91
440     1.60                      5946224446236  80.0   230   588 37.19 1.22
441     3.90                      5948124446177  56.0   230   337106.10 1.25
443     5.41                      5941704446350  34.1   230   450 48.97 1.98
444     5.41                      5941904446350  34.1   230   450 48.97 1.98
445     4.54                      5942204446350  34.1   230   450 33.46 1.98
446     4.54                      5942404446350  34.1   230   450 33.46 1.98
447     4.54                      5942654446350  34.1   230   450 33.46 1.98
448     4.54                      5942904446350  34.1   230   450 33.46 1.98
WHEELING-PITTSBURGH STEEL ALLENPORT
450     5.50                      5987524437902  15.0   235   421  9.30 0.22
451    14.60                      5987524437902  61.0   235   575 64.90 1.52
CALIFORNIA STATE COLLEGE
454     1.80                      5952314435359  46.0   238   450  7.70 1.22
ALLIED CHEMICAL
460     3.20                      5946444436862   8.0   234   355 18.90   .50
CORNING GLASS
463     1.00                      5936544444158  15.0   233   477  1.76   .46
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BEAVER VALLEY SOURCES

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J&L ALIQUIPPA

 BOILER #5,#58
5001      3.16                    5643304497350  46.6   219   533 75.28 1.30
 BOILER #6
5002     51.95                    5643104497560  76.2   232   485202.28 2.09
 NEW BOILER #6
5003     23.44                    5643104497560  61.0   232   473117.99 1.68
 A-1N. ST.
5004      1.81                    5645904497990  68.6   232   577 42.71 1.45
 A-1S. ST.
5005      1.81                    5646004497940  68.6   232   577 42.71 1.45
 A-5 ST.
5006      4.16                    5645904497790  76.2   232   577 19.66 1.68
 A-5N. REHEAT
5007       .55                    5645904497790  64.3   232   358 12.72  .56
 A-5S. REHEAT
5008       .55                    5645904497790  64.3   232   358 12.72  .56
 SOAKING PIT #2
5009      1.29                    5644204497590  53.3   232   922 13.92  .76
 SOAKING PIT #3
5010      1.29                    5644204497580  53.3   232   922 13.92  .76
 SOAKING PIT #4
5011      1.29                    5644204497570  53.3   232   922 13.92  .76
 SOAKING PIT #5
5012      1.29                    5644204497560  53.3   232   922 13.92  .76
 SOAKING PIT #6
5013      1.29                    5644204497550  53.3   232   922 13.92  .76
 SOAKING PIT #7
5014      1.29                    5644204497540  53.3   232   922 13.92  .76
 SOAKING PIT #8
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5015      1.29                               5644204497530  53.3   232   922 13.92  .87
 SOAKING PIT #9
5016      1.29                               5644204497520  53.3   232   922 13.92  .87
 SOAKING PIT #10
5017      1.29                               5643204497510  53.3   232   922 13.92  .87
 SOAKING PIT C
5018      1.62                               5643204497490  53.3   232   922 17.40  .87
 SOAKING PIT P
5019      1.62                               5643204497490  53.3   232   922 17.40  .87
 SOAKING PIT E
5020      1.62                               5643204497480  53.3   232   922 17.40  .87
 SLAB FURNACE #1
5021      1.52                               5644504497410  61.0   232   700 75.70 1.30
 SLAB FURNACE #2
5022      1.52                               5644504497420  61.0   232   700 75.70 1.30
 A-2 SLTM FURNACE
5023       .58                               5643204495640  38.1   232   977 14.68  .91
 14" MILL REHEAT
5024       .79                               5644704498000  38.1   232   700 13.70 1.25
 30" ROD MILL FURNACE #1
5025      1.03                               5642604494510  38.1   232   977 31.54  .87
 30" ROD MILL FURNACE #2
5026      1.03                               5642604494490  38.1   232   977 31.54  .87
 30" ROD MILL FURNACE #3
5027      1.03                               5642604494460  38.1   232   977 31.54 1.07
 14" PIPE MILL FURNACE #1
5028       .39                               5643204495710  38.1   232   977 12.82  .87
 14" PIPE MILL FURNACE #2
5029       .39                               5643204495720  38.1   232   977 12.82  .87
 14" PIPE MILL FURNACE #3
5030       .39                               5643204495750  38.1   232   977 12.82 1.07
 SL. ANNEX FURNACE #1
5031       .34                               5642704495720  27.4   232   700 11.28  .76
 SL. ANNEX FURNACE #2
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5032      .19                    5642704494750  27.4   232   422  3.75  .76
 ROD MILL FURNACE
5033      .84                    5642404497950  38.1   232   811 28.01  .91
 TAIL GAS
5034    12.16                    5645804497950  45.7   232   977  3.62  .53
 MEDUSA CEMENT
5380    51.60                    5568744525270    91   244   589113.30 1.83
5381     4.41                    5568744525270    40   244   560 53.00 1.68

 ARCO

 BOILER #1
5384    10.02                    5546304500620    61   229   330 59.70 0.91
 BOILER #2
5385    10.02                    5546304500620    61   229   330 59.70 0.91
 BOILER #3
5386    10.02                    5546304500620    61   229   330 59.70 0.91
 OIL BOILER
5388     2.52                    5546304500620    55   229   399 22.66 1.98
 B&W WALLACE RUN KTB 48,49
5391     3.44                    5552644515255    21   275   575 11.67 0.76
 B&W AMBRIDGE BOILERS #1,#2,  KTB #63,#64
5395     1.20                    5652834495355    26   233   450 23.40 1.14
 B&W TUBULAR PRODUCTS
5398     5.66                    5564984513322    23   268   536 32.42 0.76
5399     1.50                    5564984513322    21   268   577 16.06 0.91
 SHENANGO CHINA (INTERPACE)
5402     1.80                    5537014539975    41   245   471  7.36 0.76

 ASHLAND OIL

 CRUDE HEATER
5404      .70                    5623154504580    34   229   477  6.45  .53
 CHARGE HEATER
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5405      .50                     5623154504580    18    229    477  4.15  .26
 BOILERS #1-3
5406     3.05                     5623154504580    58    229    422 30.50 1.22
 VACUUM HEATER
5407      .30                     5623154504580    34    229    477  2.28  .53
 NRV, RERUN & BRIGHT ST. HEATERS
5408     1.10                     5623154504580    18    229    477  2.90  .26
 WESTINGHOUSE ELECTRIC BEAVER
5413     2.63                     5575284486194    15    243    515 24.69 0.71
 HERCULES INC.
5469     0.00                     5973514449231    15    232    533 11.16 0.46

 WEST PENN POWER WEST PITTSBURGH

 UNIT #1
5472   236.60                     5531054531767   145    238    413663.37 4.00
 UNIT #2
5473     0.00                     5531054531767   145    238    444108.50 2.05
 UNIT #3
5474     0.00                     5531054531767   145    238    406169.90 2.05
 UNIT #4
5475     0.00                     5531054531767   145    238    423176.90 2.05
 UNIT #5
5476     0.00                     5531054531767   145    238    417296.90 2.05
 PENN POWER MANSFIELD
5479   461.03                     5490494498067   290    219    341740.36 2.90
5480   230.46                     5490494498067   183    219    341740.36 2.90

 ST. JOE MINERALS

 275' STACK
5512    88.45                     5552234501841    84    236    422 80.20 1.68
 200' STACK
5513 0    6.8                     5561604502218    61    236    347122.3  1.52
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 400' STACK
5514 0  209.3                     5560654502301   122   236   336 213.7 2.74

 BESSEMER CEMENT

 UNIT #2
5518 0   25.5                     5428604535850    67   320   477 51.4  1.68
 UNIT #2
5519 0   33.0                     5428604535850    67   320   505 91.6  1.98

                     OTHER PENNSYLVANIA SOURCES


 ARMSTRONG POWER
6021    520.0                     6289794531996  70.0   258   405 160.0 2.30
6022    600.0                     6289794531996  70.0   258   439 285.0 2.30
 CARPENTERTOWN COAL
6031      0.00                    6329974530988   5.0   274   9921177.4  .10
 KEYSTONE POWER
6041   5198.9                     6401414502155 244.0   311   4081193.8 4.60
 HOMER CITY POWER
6051   4752.4                     6527564486147 244.0   366   405 967.6 4.70
 CONEMAUGH POWER
6061   4712.3                     6645824471929 305.0   330   4081194.0 4.10
 SEWARD POWER
6071    854.0                     6668824474602  69.0   332   414 207.0 1.50
6072      0.0                     6668824474602  69.0   332   450 126.7 1.20
 HATFIELD POWER
6081   5792.5                     5915704412040 213.4   220   411 935.0 3.45
 AVERTON FUEL
6091      3.2                     6192894443933   5.0   334   922 221.3  .10
6092      6.9                     6205444443891   5.0   334   922  88.5  .10
 SLIPPERYROCK COLLEGE
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6101      31.2                         5798254545763  53.0   412   505  25.6   .90
 SUNNEBORN
6111      58.3                         6077764540569  61.0   366   505  15.8 1.25
 SHENLEY DISTILLERS
6121      27.1                         6134204505200  24.0   251   477   7.4   .80

                 EASTERN OHIO SOURCES

    NOTE: 1975 EMISSIONS DATA WERE USED FOR THE NON-POWER GENERATING
          SOURCES DUE TO A LACK OF COMPLIANCE DATA.
          COMPLIANCE DATA FOR THE OHIO POWER STATIONS WAS OBTAINED
          FROM EPA REGION III.
          REVISED BY REGION III:  05 NOVEMBER 1979
          (CONVERSATIONS WITH OHIO & REGION V)


 FEDERAL PAPERBOARD
8003      60.3                         5332004468900    66   256   544 19.45 1.52
 KAOL CLAY
8011       2.55                        5330004481300    46   283   421  1.43 1.51
 OHIO POWER TORONTO  75% LOAD        (REVISED 11/5/79)
8023    1850.6                         5335004481800   198   201   441368.40 2.29
 OHIO EDISON SAMMIS  75% LOAD        (REVISED 11/5/79)
8031     610.5                         5317004485500   154   210   405598.03 3.20
8032     610.5                         5317004485500   154   210   405619.21 3.05
8035    4224.0                         5317004485500   259   210   405507.11 4.76
8036    2816.3                         5317004485500   305   210   4051050.9 4.09
 OHIO EDISON BURGER
8041    3987.0                         5205004417500   259   198   4661088.0 3.30
 OHIO EDISON TIDD                       (SHUT DOWN)
8051       0.0                         5299004455700    75   207   455 99.10 1.50
8052       0.0                         5299004455700    75   207   455 99.10 1.50
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8053       0.0                     5299004455700   75   207   455234.91 2.15
 CARDINAL POWER  75% LOAD         (REVISED 11/5/79)
8061    3451.5                     5300004455800  252   198   447897.84 3.36
8062    3451.5                     5300004455800  252   198   447897.84 3.36
8063    1126.5                     5300004455800  274   204   4301025.5 3.66
 TORONTO PAPERBORD
8071      31.9                     5337004480200   19   215   533 16.76 1.05
 NATIONAL STEEL WEIRTON DIVISION
8081       1.54                    5327004467000   47   204   516  6.13  .85
8082       1.54                    5327004467000   47   204   516  6.13  .85
8083       1.54                    5327004467000   47   204   516  6.13  .85
8084       1.54                    5327004467000   47   204   516  6.13  .85
 WHEELING-PITTSBURGH NORTH PLANT
8091      30.4                     5325004466700   77   204   589 47.66 1.70
8092      30.1                     5325004466700   36   204   505 32.39 1.20
8093      29.4                     5325004466700   36   204   505 31.67 1.20
8094      30.2                     5325004466700   36   204   505 32.48 1.20
8095       3.8                     5325004466700   46   204   533  2.67  .75
8096       7.7                     5325004466700   46   204   644  6.41 1.05
8097       7.7                     5325004466700   44   204   644  6.41 1.05
8098       7.7                     5325004466700   46   204   644  6.41 1.05
8099       3.8                     5325004466700   46   204   644  3.50  .75
 WHEELING-PITTSBURGH SOUTH PLANT
8121      39.3                     5346004463300   91   204   589 66.27 2.35
8122       6.8                     5346004463300   49   204   519 12.25 1.00
8123       6.8                     5346004463300   49   204   519 12.25 1.00
8124       6.8                     5346004463300   49   204   519 12.25 1.00
8125       6.8                     5346004463300   49   204   519 12.25 1.00
8126       6.8                     5346004463300   49   204   519 12.25 1.00
8127       6.8                     5346004463300   49   204   519 12.25 1.00
8128       6.8                     5346004463300   49   204   547 12.88 1.00
8129       6.8                     5346004463300   49   204   547 12.88 1.00
8130       4.8                     5346004463300   33   204   644  1.48  .90
8131       4.8                     5346004463300   33   204   644  1.48  .90
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8132      4.8                    5346004463300    50   204   644  1.48  .90
8133      4.8                    5346004463300    50   204   644  1.48  .90
8134      4.8                    5346004463300    50   204   644  1.48  .90
 WHEELING-PITTSBURGH YORKVILLE
8141     43.6                    5254004445400    58   205   450 26.98 1.67
8142     54.5                    5254004445400    60   205   450 41.62 1.67
 WHEELING-PITTSBURGH MARTINS FERRY
8151      9.6                    5247004439200    24   202   511 12.39  .61
8152     26.2                    5247004439200    38   202   516 40.00 1.55
 OHIO EDISON EAST PALESTINE        (SHUT DOWN)
8161      0.0                    5359004520300    30   314   561 38.17 1.50
8162      0.0                    5359004520300    29   314   561 26.15  .75
8163      0.0                    5359004520300    58   314   561 26.15  .75

                    WEST VIRGINIA SOURCES

     NOTE: WEST VIRGINIA EMISSIONS DATA WERE OBTAINED FROM DATA
           PROVIDED BY WEST VIRGINIA AND REGION X:  1978A
     NOTE: REVISED BY REGION III:  05 NOVEMBER 1979
           COMMUNICATION WITH WEST VIRGINIA


 ALLIED CHEMICAL
   #1,#2 COAL-FIRED BOILER      (REVISED 11/5/79)
9001     42.0                    5167004417000    31   203   299  6.20 1.00
   #3,#4 COAL-FIRED BOILER      (REVISED 11/5/79)
9002     42.0                    5167004417000    31   203   293  6.50 1.30
   NORTH PLANT COAL-FIRED BOILERS
9003     12.9                    5167004417000    20   203   800 15.00 1.00
 BANNER FIBREBOARD
   TWO OIL-FIRED BOILERS
9011     14.0                    5333004458800     7   204   575 11.70  .50
 BLAW-KNOX PENINSULA PLANT
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   #3 OPEN HEARTH
9021       2.1                    5239004436400    40    201    755  9.49   .58
 CITY SERVICE
   #1 REACTOR
9042       1.2                    5115004398700    23    204    507 19.20   .46
   #2 REACTOR
9043       1.2                    5115004398700    23    204    507 12.60   .57
   #3 REACTOR
9044       1.5                    5115004398700    24    204    507 14.90   .61
   #4 REACTOR
9045       1.5                    5115004398700    24    204    507 14.90   .61
 DIECKMANN & SONS
   THREE COAL-FIRED BOILERS
9050       8.5                    5308004434000    25    209    633 11.20   .60
 GLOBE REFRACTORY
   #5A TUNNEL KILN
9061      40.0                    5319004495700    12    207    533 21.40   .73
   #5B TUNNEL KILN
9062      40.0                    5319004495700    12    207    533 21.40   .73
   #4 TUNNEL KILN
9063      10.0                    5319004495700    11    207    583  7.15   .73
   #2 TUNNEL KILN
9064       6.4                    5319004495700     6    207    516  3.46   .43
 H B REED
9071        .1                    5159004407400    12    204    327  6.68   .42
 KAMMER POWER
9081   2770.0                     5153204410320   183    197    442613.10 2.38
9082   1385.0                     5153304410330   183    197    442305.90 1.68
 KOPPERS
   #2 COAL/OIL-FIRED BOILER      (REVISED 11/5/79)
9091       8.0                     5334004465500    61    204    589 30.90 1.55
   #3 COAL/OIL-FIRED BOILER      (REVISED 11/5/79)
9092      13.0                     5334004465500    44    204    589 18.40 1.07
   #4 COAL-FIRED BOILER          (REVISED 11/5/79)
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9093     28.0                      5334004465500    58    204    477 25.20   .68
   F2 FLARE                       (REVISED 11/5/79)
9095     39.0                      5334004465000    15    204    789  2.58   .38
   H2S FLARE                      (REVISED 11/5/79)
9096       .5                      5334004465000    21    204   1144  1.60   .08
   #5 COAL-FIRED BOILER
9097     50.0                      5334004465000    61    204    477 35.7   1.55
 MITCHELL POWER
9101   9289.0                      5158004408670   366    210    4412410.0 5.03
 MOMBAY CHEMICALS
   #9,#10 OIL-FIRED BOILERS       (REVISED 11/5/79)
9111     85.0                      5147004397200    15    199    452 14.28   .88
 OHIO VALLEY MEDICAL CENTER
   THREE COAL/OIL-FIRED BOILERS
9131      4.6                      5238004434300    38    219    633  4.75 1.10
 PPG
   #4 COAL-FIRED BOILER           (REVISED 11/5/79)
9141    175.0                      5126004399600    69    200    450 79.70 2.45
   #5 COAL-FIRED BOILER           (REVISED 11/5/79)
9142    308.0                      5126004399600    91    200    436123.60 1.35
   SULFUR RECOVERY
9143     45.0                      5127004399800    31    207    477  2.36   .38
 QUAKER STATE REFINERY
   #1 OIL-FIRED BOILER            (REVISED 11/5/79)
9151     57.0                      5309004496200    46    207    561 37.70   .91
   #2 OIL-FIRED BOILER            (REVISED 11/5/79)
9152     57.0                      5309004496200    46    207    561 37.70   .91
   #3 OIL-FIRED BOILER            (REVISED 11/5/79)
9153     57.0                      5309004496200    46    207    561 37.70   .91
   H-101 CRUDE HEATER
9154     12.0                      5309004496200    38    207    522  7.10   .46
   PLATEFORMER
9155      6.0                      5309004496200    38    207    533 10.20   .84
   150 HEATER
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9156      4.0                       5309004496200    38    207    700  7.90   .91
   WASTE GAS FLARE
9157     12.0                       5309004496200    67    207    866   .05   .70
 ST. GEORGE
   TWO COAL-FIRED BOILERS
9161      3.8                       5329004458200    24    204    633   .50   .53
 TAYLOR SMITH & TAYLOR
   TWO COAL-FIRED BOILERS
9181      7.2                       5373004496300    38    207    477  4.67   .57
 TRIANGLE CONDUIT
   THREE COAL-FIRED BOILERS
9191     21.5                       5209004420300    24    207    586  8.80   .57
 US STAMPING
   TWO COAL-FIRED BOILERS
9201      5.6                       5225004419400    24    209    421  1.32   .54
 VALLEY CAMP COAL #1
   #2 THERMAL DRYER
9211      5.5                       5308004444800    23    255    394 54.10  2.55
   #1 THERMAL DRYER
9212      5.5                       5308004444800    26    255    394 45.20  1.10
 VALLEY CAMP COAL #3
   #1 THERMAL DRYER
9221      2.8                       5333004434600    24    248    394 15.10   .91
   #2 THERMAL DRYER
9222      1.7                       5333004434600    26    248    394  9.10   .91
*
* NATIONAL STEEL
*
 BROWNS ISLAND COKE
   BATTERY UNDERFIRE
9231     18.6                       5333004474800    76    232    533 53.60  2.06
   GAS FLARE
9232      2.0                       5333004474800    42    232    866 19.20   .38
   BATTERY AREA
92331      .3                       5333004474800    25    232    100   100
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 MAINLAND COKE
   BATTERY #5 UNDERFIRE
9252       9.1                   5338004474600    76    232    555 19.20 1.37
   BATTERY #6 UNDERFIRE
9253       9.1                   5338004474600    76    232    555 19.20 1.37
   BATTERY #7 UNDERFIRE
9254      10.6                   5338004474600    76    232    555 22.40 1.68
   BATTERY #8,#9 UNDERFIRE
9255      14.0                   5338004474600    76    232    555 14.94 1.30
   BATTERY AREA
92571      3.8                   5338004474600    18    232    100   100
 NATIONAL STEEL
   #2 WIND BOX
9262      89.0                   5343004474100    49    232    422257.00 2.29
 WHEELING HOSPITAL
   COAL-FIRED BOILERS
9271       1.5                   5234004436800    35    207    633  2.16  .91
 WHEELING-PITTSBURGH STEEL BENWOOD
     #1,#2 COAL BOILERS
9281       3.9                   5229004430200    21    198    450 10.00  .66
     DESULFURIZATION
9285      15.0                   5335004465600    26    204    335  3.30  .30
     #8 BATTERY UNDERFIRE
9286      13.0                   5335004465600    76    204    422 43.10 1.98
     #4,#5 BOILERS             (REVISED 11/5/79)
9287       7.0                   5336004465600    38    204    630 25.10 1.15
     #6-8 BOILERS              (REVISED 11/5/79)
9288      79.0                   5336004465600    70    204    630 37.70 1.37

 WHEELING-PITTSBURGH FOLLENSBEE PLANT

     #1 BATTERY UNDERFIRE
9291       2.5                   5335004465900    61    204    616 19.90 1.26
     #2 BATTERY UNDERFIRE
 9292      2.5                       5335004465800    61    204    616 19.90 1.26
      #3 BATTERY UNDERFIRE
 9293      2.8                       5335004465700    69    204    616 22.40 1.22
      #1-3,#8 AREA SOURCES
 92971     3.4                       5335004465600    18    204    100   100
      #1 STRAND WIND BOX
 9301     18.7                       5335004465200    30    204    325 81.80 1.22
*
* NATIONAL STEEL WEIRTON DIVISION
*
      #1-3 COAL-FIRED BOILERS
 9341    540.0                       5343004474400    43    204    505118.20 1.52
      #4 COAL-FIRED BOILER         (REVISED 11/5/79)
 9344    185.0                       5343004474400    43    204    505118.00 1.52
      #5 COG-FIRED BOILER          (REVISED 11/5/79)
 9345    211.0                       5343004474400    55    204    505 91.40 1.68
      P1,P2 GAS BOILERS            (REVISED 11/5/79)
 9346    158.0                       5343004474400    67    204    505 76.00 2.30
      #15 COG BOILER
 9351     16.0                       5343004474400    67    204    530 96.00 2.30
      #6,#7 HEAT EXCHANGERS
 9352     22.0                       5348004473800    61    204    333118.00 2.70
      60 T REHEAT
 9353      2.6                       5350004473000    46    204    540  4.20 1.06
      #1-4 REHEATS                 (REVISED 11/5/79)
 9354    295.0                       5350004473000    61    204    520 41.60 1.45
      #1,#2 SPELTERS
 9355      2.3                       5350004472900    40    204    650  5.00  .86
      #3,#4 SPELTERS
 9356      1.5                       5350004472900    26    204    650  2.37  .44
      ANNEALING FURNACE
 9357       .2                       5350004473000    29    204    480   .56  .69
      #1-12 ANNEALING FURNACES
 9358       .6                       5350004473000    15    204    480   .22  .17
      TIN MILL
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9359      1.5                              5350004473000    30    204    420   1.10 1.07
     BLOOMING FURNACE
9360     19.6                              5350004473000    53    204    505   4.78  .95
     HCL REGENERATOR
9361      4.2                              5351004472500    24    232    366   4.20  .30
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                     APPENDIX C.2

     SWPA AQCR SHORT TERM COMPLIANCE EMISSIONS INVENTORY

SOURCE  SOURCE STRENGTH G/S           UTM        HT    ELE  TEMP. VOL.   R
  NO.   ANNUAL SEA 2 SEA 3 SEA 4      X     Y    (M)   (M)   K    M/S3  (M)

    ALLEGHENY COUNTY SOURCES AS SUPPLIED BY ACBAPC/ENVIROPLAN
                RECEIVED FROM ENVIROPLAN:  19 SEPTEMBER 1979
                REVISED BY REGION III (MARK):  05 OCTOBER 1979

PITTSBURGH BREWING
  1    12.90
                             5875504479280  58.0   226   488  16.9 1.60
KOPPERS
  2     2.87
                             5744004468100  28.6   250   533  34.1  .62
  3     3.00
                             5744004468100  28.6   250   637  18.4  .76
12TH STREET STEAM PLANT
  4    87.20
                             5852004477600  82.0   221  .604 265.5 2.20
WEST PENN. POWER SPRINGDALE
  5    16.50
                             6043804488740  64.3   227   472 185.5 2.44
  6    17.50
                             6043804488740  64.3   227   444 192.7 1.85
DUQUESNE LIGHT CHESWICK
  7  1864.00
                             6023304487800 229.0   229   5581024.6 3.20
SATELLITE ALLOY
 81     5.78
                             6042004488500  10.0   229   100   100
EDGE STEEL
  9      .90
                             5976004485200  38.1   220   348  21.8  .76
DUQUESNE LIGHT BRUNOT ISLAND TURBINES
 10    87.40
                             5806804479680  10.0   222   735 248.6 2.06
 11   242.40
                             5806804479680  19.2   222   467 333.7 1.91
MARQUET CEMENT
 12    47.80
                             5783004482600  46.0   222   491  94.0 1.90
SHENANGO BATTERIES #2,#3        (REVISED 10/5/79)
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*     SWPA AQCR COMPLIANCE EMISSIONS INVENTORY:  06 OCTOBER 1979
*                        WORST CASE SHORT TERM
*
*
*SOURCE  SOURCE STRENGTH G/S            UTM         HT    ELE  TEMP. VOL.   R
*  NO.   ANNUAL SEA 2 SEA 3 SEA 4      X     Y     (M)    (M)   K    M/S3  (M)
*
*
*     ALLEGHENEY COUNTY SOURCES AS SUPPLIED BY ACBAPC/ENVIROPLAN
*                  RECEIVED FROM ENVIROPLAN:  19 SEPTEMBER 1979
*                  REVISED BY REGION III (MARK):  05 OCTOBER 1979
*
* PITTSBURGH BREWING
    1    12.90                      5875504479280  58.0   226   488  16.9 1.60
* KOPPERS
    2     2.87                      5744004468100  28.6   250   533  34.1  .62
    3     3.00                      5744004468100  28.6   250   637  18.4  .76
* 12TH STREET STEAM PLANT
    4    87.20                      5852004477600  82.0   221   604 265.5 2.20
* WEST PENN. POWER SPRINGDALE
    5    16.50                      6043804488740  64.3   227   472 185.5 2.44
    6    17.50                      6043804488740  64.3   227   444 192.7 1.85
* DUQUESNE LIGHT CHESWICK
    7  1864.00                      6023304487800 229.0   229   5581024.6 3.20
* SATELLITE ALLOY
   81     5.78                      6042004488500  10.0   229   100   100
* EDGE STEEL
    9      .90                      5976004485200  38.1   220   348  21.8  .76
* DUQUESNE LIGHT BRUNOT ISLAND TURBINES
   10    87.40                      5806804479680  10.0   222   735 248.6 2.06
   11   242.40                      5806804479680  19.2   222   467 333.7 1.91
* MARQUET CEMENT
   12    47.80                      5783004482600  46.0   222   491  94.0 1.90
* SHENANGO BATTERIES #2,#3        (REVISED 10/5/79)
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   13     4.84                    5780504483110  76.0   222   588 106.0 1.05
 * SHENANGO BATTERY #4           (REVISED 10/5/79)
   14     3.83                    5779404483200  69.0   222   478  62.0 1.05
 * SHENANGO BOILERS #7,#8        (REVISED 10/5/79)
   15     0.00                    5783304482800  26.0   222   452  38.0  .90
 * SHENANGO BOILER #9            (REVISED 10/5/79)
   16     6.46                    5783604482790  38.7   222   627 155.0 1.50
 * VULCAN MATERIALS
   17     3.70                    5748004484600  20.3   223   553  10.2  .50
   18     2.50                    5748004484600  17.2   223   553   2.4  .50
 * PITTSBURGH ACTIVATED CARBON
   19     2.15                    5781004482500  12.2   223   533    .7  .20
   20     2.80                    5781004482500  18.9   223  1255   5.3  .38
   21     1.30                    5781004482500  17.8   223  1144  25.0  .52
 * ALCOSAN
   22     8.40                    5814004480800  91.4   230   344  23.5 1.22
 * DUQUESNE LIGHT PHILLIPS POWER STATION
   23   443.50                    5652604491020 104.0   226   322 340.4 3.96
 * DRAVCO
   70     7.20                    5786004482600  25.6   226   416  20.7  .75
 * USS CHEMICAL NEVEL ISLAND
   71     2.20                    5780004483000  30.5   223   322   5.6  .30
   72    15.40                    5779004483700  12.2   223   541  18.8  .60
 * NEVEL CHEMICALS
   73     3.90                    5764004483700  12.0   223   573   8.0  .61
   74     4.60                    5764004483700  14.0   223   543   6.8  .61
 * BLAWNOX
   75     2.50                    5878004480400  22.3   223   352  14.6  .55
   76     2.20                    5878004480400  22.3   223   352  10.7  .55
   77     1.90                    5878004480400  22.3   223   352   9.9  .55
 * HAHN
   78     3.80                    5862004484900  47.2   329   394  10.8  .60
 * BLTZHVR
   79      .50                    5848004474400  18.3   305   408   1.0  .50
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* PERRY
   80     5.30                  5831004482300  18.3   354   408  10.3  .50
* OVERBROOK
   81      .50                  5851004471200  18.3   280   408    .9  .50
* SOUTH HILLS
   82     3.80                  5844004475000  18.3   335   408   7.5  .50
* 21ST STREET STEAM
   83      .20                  5864004478100  18.3   268   408    .8  .50
* MORSE
   84      .50                  5874004475500  18.3   229   408   1.0  .50
* LATIMER
   85     1.90                  5846004478700  18.3   244   408   3.7  .50
* MCKEYSPORT HOSPITAL
   86     2.80                  5990004466600  27.4   274   408   5.4  .70
   87      .60                  5965004466900  18.3   238   408   1.2  .50
* ST. JOSEPH'S HOSPITAL
   88     2.00                  5816004480900  40.0   238   408   3.9  .55
* PPG
   89      .60                  6044004494200  73.2   274   514  18.7 1.85
   90      .50                  6044004494200  39.2   274   514  10.1  .90
* GLASSMERE
   91      .10                  6036004492500  15.2   229   644   6.2  .60
* DUQUESNE LIGHT MANSFIELD
   92      .30                  5821004478900  12.2   232  1033   3.9  .45
* SHENANGO BLAST AREA         (REVISED 10/5/79)
  941      .55                  5782204482970  10.0   222   100   100
* SHENANGO BOILER #10         (REVISED 10/5/79)
   95     6.15                  5783904482780  33.5   222   477142.79 1.50
* SHENANGO BATTERY #2 AREA    (REVISED 10/5/79)
  961     0.00                  5780504483120  10.0   222   100   100
* SHENANGO BATTERY #3 AREA    (REVISED 10/5/79)
  971     0.00                  5779804483160  10.0   222   100   100
* SHENANGO BATTERY #4 AREA    (REVISED 10/5/79)
  981     0.00                  5779504483210  10.0   222   100   100
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* SHENANGO MISCELLANEOUS AREA     (REVISED 10/5/79)
  991    0.00                      5779604483160  10.0   222   100   100
* SHENANGO D/S PLANT
  100    17.63                     5780604482940  34.3   222   976   1.0  .22
*
* USS CLAIRTON
*
* BATTERY #1
  110      2.45                    5958954461555  69.0   229   588  37.4 1.22
* BATTERY #2
  111      2.45                    5958804461565  69.0   229   588  37.4 1.22
* BATTERY #3
  112      2.45                    5957454461715  69.0   229   588  37.4 1.22
* BATTERY #7
  113      2.45                    5959304461590  65.0   229   575  35.6 1.27
* BATTERY #8
  114      2.45                    5959304461590  65.0   229   575  35.6 1.27
* BATTERY #9
  115      2.45                    5959304461590  65.0   229   575  35.6 1.27
* BATTERY #13
  120      2.35                    5953604461925  61.0   229   575  45.9 1.50
* BATTERY #14
  121      2.35                    5953504461935  61.0   229   575  45.9 1.50
* BATTERY #15
  122      2.35                    5952154462105  61.0   229   575  45.9 1.50
* BATTERY #19
  125      4.13                    5952254461875  76.0   229   577  50.4 2.14
* BATTERY #20
  126      4.13                    5952104461895  76.0   229   577  50.4 2.14
* BATTERY #21
  127      4.13                    5951104462140  76.0   229   575  51.5 2.14
* BATTERY #22
  128      4.13                    5949954462160  76.0   229   575  51.5 2.14
* TAIL GAS
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  129      2.47             5957154461695  46.0   223   561  18.0  .61
* REHEAT MILLS
  130      1.59             5958714461000  18.0   224   811  70.0  .70
  131      1.59             5958674460980  18.0   224   811  70.0  .70
  132       .60             5960094460924  30.5   224   811  70.0  .60
  133       .60             5959964460929  30.5   224   811  70.0  .60
  134       .60             5959824460933  30.5   224   811  70.0  .60
  135       .60             5959694460930  30.5   224   811  70.0  .60
  136       .44             5958334461020  25.9   226   811  11.8  .65
  137       .44             5958274461004  25.9   226   811  11.8  .65
  138       .44             5958224460991  25.9   226   811  11.8  .65
* BOILER #1
  141     67.30             5949584462545  50.0   226   478  91.7 1.33
* BOILER #2
  142     45.90             5949334462564  50.0   226   478  80.4 1.06
* BOILER #13
  143     16.40             5947604462427  27.0   226   613  62.3 1.14
* BOILER #14
  144     16.40             5947894462402  27.0   226   613  62.3 1.14
* BOILER R1,R2
  145     24.40             5948004462400  50.0   227   444  48.8 1.52
*
* USS DUQUESNE
*
* SOAKING PITS
  146     33.00             5981874470077  54.9   229   600  23.9 1.20
  147     33.00             5982104470053  54.9   229   600  23.9 1.20
  148     33.00             5982324470025  54.9   229   600  23.9 1.20
  149     33.00             5982554469998  54.9   229   600  23.9 1.20
* HEAT TREATING
  1501     8.70             5978834470353  10.0   229   100   100
* REHEAT FURNACE
  151      1.80             5978974470169   8.0   229   811  12.5  .62
  152      1.80             5979044470162   8.0   229   811  12.5  .62
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   153      3.15                          5978574470162  37.0   229   589    8.8  .90
   154      3.15                          5978734470143  37.0   229   589    8.8  .90
   155      3.15                          5978844470129  37.0   229   589    8.8  .90
 * BOILER #15
   157      1.36                          5985624469030  49.0   229   478   33.4 1.15
 * BOILER #17
   158      1.36                          5985434469062  49.0   229   478   33.4 1.15
 *
 * USS NATIONAL
 *
 * SINTER PLANT
   159      0.00                          5977204467400  27.4   229   330    3.4  .94
 * SOAKING PITS
   160      1.43                          5976804467485  27.0   229   616    4.9  .62
   161      1.43                          5976904467490  27.0   229   616    4.9  .62
   162      1.43                          5977104467492  27.0   229   616    4.9  .62
   163      1.43                          5977154467493  27.0   229   616    4.9  .62
   164      1.43                          5977304467494  27.0   229   616    4.9  .62
   165      1.43                          5977454467495  27.0   229   616    4.9  .62
   166      1.48                          5977604467497  27.0   229   616    5.9  .62
   167      1.48                          5977704467498  27.0   229   616    5.9  .62
   168      1.48                          5977854467499  27.0   229   616    5.9  .62
   169      1.48                          5977974467500  27.0   229   616    5.9  .62
 * ROTARY
   170     24.60                          5967444467549  38.0   229  1089   98.5  .88
 * HEAT FURNACE
   171      8.86                          5966664467575  38.0   229   533   30.6  .76
   172      8.86                          5966684467563  38.0   229   533   30.6  .76
 * REHEAT FURNACE                       (REVISED 10/5/79:  ADD SOURCE #300)
   173      2.00                          5967814467574  38.0   229   533    7.4  .68
   174      2.00                          5967994467578  38.0   229   533    7.4  .68
   175      2.00                          5969324467442  38.0   229   533    7.4  .68
 * NORMALIZER
   176      2.65                          5969254467478  14.0   229   533    1.0  .25
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  177       .75                5970754467532  14.0   229   477  16.9   .65
* WALKING FURNACE
  178      1.71                5967044467557  38.5   229   532   5.6   .68
* WARM FURNACE
  1791     3.84                5972404467600  10.0   229   100   100
* BOILER #1
  180     16.90                5972154467595  44.7   221   635 101.5 1.34
* BOILER #2
  181     16.90                5972154467580  44.7   221   635 101.5 1.34
* BOILER #3
  182     16.90                5972254467580  44.7   221   635 101.5 1.34
* BOILER #4
  183     16.90                5972254467595  44.7   221   635 101.5 1.34
* BOILER #5
  184     16.90                5974004467330  44.7   221   635 101.5 1.34
*
* USS IRVIN
*
* SLAB HEATING
  185     19.76                5931454465680  21.3   283   450  46.7 1.30
  186     19.76                5931504465628  21.3   283   450  46.7 1.30
  187     19.76                5931554465693  21.3   283   450  46.7 1.30
  188     19.76                5931574465710  21.3   283   450  46.7 1.30
  189     25.65                5931564465725  21.3   283   450  46.7 1.50
* BOILERS #3,#4
  190     16.90                5932134465750  32.0   283   643 109.0 1.52
* BOILERS #5,#6
  191     20.70                5932194465765  32.0   283   643 115.6 1.52
* BOILER #7
  192     11.50                5932104465712  26.5   283   455  42.5   .91
*
* USS CLAIRTON
*
* BATTERY B
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  193     6.76                5956804461900  83.8   229   575 80.01 2.74
* BATTERY C
  194     6.76                5955004462100  83.8   229   575 80.01 2.74
* BOILERS T1,T2
  195    21.70                5947704462400  26.5   226   444 20.93  .73
*
* USS NATIONAL
*
* TEMPERING
  1961    0.00                5967044467557  10.0   229   100   100
* DUQUESHE LIGHT STANWICK
  201    77.60                5843804477300  97.5   220   574 217.2 2.40
* H J HEINZ
  202    13.70                5860004478900  76.0   222   464  70.3 1.50
  203    22.60                5860004478900  76.0   222   464 103.1 1.50
* WESTINGHOUSE ELECTRIC
  204     5.20                5990204472550  37.1   308   466  23.4  .99
* BELLEFIELD BOILERS
  205    28.20                5891904477100  59.4   256   589  49.6 1.40
  206    29.90                5891904477100  77.7   256   517  91.9 1.70
* WABCO
  207     5.40                5944004475550  27.0   274   569  19.3  .70
* MESTA MACHINE
  208      .10                5909204471980  61.0   229   393  18.8  .90
* B&O RAILROAD
  209     3.30                5898004472500  38.0   230   533  99.6 1.06
* UNIVERSAL ATLAS
  210    63.80                6003004479400  16.7   371   513 202.5 1.10
*
* USS HOMESTEAD
*
* OPEN HEARTH
  211    29.54                5924504473650  37.0   229   533  94.0 1.98
  212    29.54                5924754473685  37.0   229   533  94.0 1.98
  213    29.54                  5925104473750  37.0   229   533  94.0 1.98
  214    29.54                  5925204473760  37.0   229   533  94.0 1.98
  215    29.54                  5925504473820  37.0   229   533  94.0 1.98
* SOAKING PITS
  216     1.68                  5918954473025  37.0   229   533   6.5  .84
  217     1.68                  5919004473035  37.0   229   533   6.5  .84
  218     1.68                  5919034473045  37.0   229   533   6.5  .84
  219     1.68                  5919054473050  37.0   229   533   6.5  .84
  220     2.59                  5919104473060  31.0   229   533  10.0  .76
  221     2.59                  5919134473070  31.0   229   533  10.0  .76
  222     2.59                  5919154473080  31.0   229   533  10.0  .76
  223     2.59                  5919204473090  31.0   229   533  10.0  .76
  224     2.59                  5919254473100  31.0   229   533  10.0  .76
  225     2.59                  5919304473110  31.0   229   533  10.0  .76
  226     2.59                  5919354473120  31.0   229   533  10.0  .76
  227     2.59                  5919404473130  31.0   229   533  10.0  .76
  228     2.59                  5919504473140  31.0   229   533  10.0  .76
  229     2.59                  5919604473150  31.0   229   533  10.0  .76
  230     2.59                  5919654473160  31.0   229   533  10.0  .76
  231     2.59                  5919704473170  31.0   229   533  10.0  .76
  232     2.66                  5919754473180  44.0   229   533   7.5 1.05
  233    16.15                  5931084473742  50.0   230   533 117.2  .84
  234    13.76                  5930924473742  50.0   230   533 117.2  .84
* 36" MILL
  235     2.60                  5932254473733  23.0   230   477  28.5  .40
  236     2.17                  5932254473755  35.0   230   477   8.8  .76
* BLACKSMITH
  237     1.36                  5934254474000  23.0   227   477  12.0  .38
* 100" MILL
  238    31.54                  5918874473270  38.0   227   477  17.2  .80
* NORMALIZER
  2391     .41                  5918874473270  10.0   229   100   100
* PREHEAT HOODS
  2401    9.70                  5923804473606  10.0   229   100   100
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* 160" REHEAT FURNACE
  241     9.07                5919754473450  70.0   227   477  25.9 1.52
* 160" IN-OUT FURNACE
  242     4.05                5919584473250  31.0   227   477   7.0  .68
  243     1.95                5919504473450  31.0   227   477   3.4  .68
* #2 FORGE
  244     4.63                5927334473833  30.0   229   477   6.8  .91
  245     1.23                5927334473833  30.0   229   477   3.4  .38
  246      .99                5927334473833  24.0   229   477   2.8  .38
  247      .99                5927334473833  24.0   229   477   5.5  .91
  248     5.60                5927334473833  24.0   229   477   9.5  .99
  249     1.47                5927334473833  18.0   229   477   1.5  .38
  250     4.66                5927334473833  29.0   229   477  10.1  .99
* HARVEY FORGE
  251     3.40                5932254473893  24.0   229   477   1.0  .68
  252      .80                5932254473893  25.0   229   477   1.7  .68
  253     2.40                5932254473893  24.0   229   477   1.7  .68
  254      .80                5932254473893  24.0   229   477   1.4  .68
* 48" MILL
  255     1.40                5938654473555  32.0   229   477   3.4  .68
* BOILER #3
  256    57.80                5942924474640  44.7   222   588 270.4 1.75
* BOILER #4
  257    46.65                5942834474750  44.7   222   588 167.9 1.25
*
* USS EDGAR THOMSON
*
* SOAKING PITS
  258    21.16                5974404471870  30.0   233   533  42.1  .88
* RILEY BOILER #1
  259    32.84                5970834471740  50.0   221   616  69.6 1.91
* RILEY BOILER #2
  260    32.84                5972604471685  50.0   221   616  69.6 1.91
* RILEY BOILER #3
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  261    32.84                      5972764471673  50.0   221   616  69.6 1.91
*
* J&L PITTSBURGH
*
* KEELER BOILER
  262     1.75                      5892604473890  24.4   235   405   9.3  .66
* RILEY BOILER
  263     5.95                      5892604473890  21.7   235   566  13.2  .98
* SOUTHSIDE BOILERS
  264    62.10                      5880004475340  36.0   225   461  38.7 1.22
* 10" MILL
  266     1.47                      5892804474080  38.1   238  1089  25.5 1.06
* 14" MILL
  267     5.96                      5893004474120  38.1   238  1089   8.9  .84
* COKE BATTERIES
  268     5.56                      5891304474010  61.0   235   634  54.7 1.30
  269     5.56                      5891604473900  61.0   235   634  54.7 1.30
  270     3.93                      5892604473760  69.0   235   533  50.9 1.45
* SOAKING PITS "D"
  281     4.02                      5877804475520  46.0   226   811  18.7  .95
  282      .75                      5877804475520  46.0   226   700   7.0  .95
*
* USS HOMESTEAD
*
* PACKAGE BOILERS #1-3
  283    11.52                      5925754473900  15.0   226   561 25.74 1.60
*
* USS EDGAR THOMSON
*
* B&W BOILERS
  284    00.00                      5972724471676  33.0   221   551 26.19 1.20
*
* J&L PITTSBURGH
*
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* SLAB HEAT FURNACE
  285      0.68                          5883004475790  22.7   235   839 22.34 1.30
* TAIL GAS
  286     21.20                          5891804474100  30.5   235   350  5.31  .17
* ELECTRIC FURNACE
  2871     0.80                          5881004475140  10.0   235   100  100.
* MISCELLANEOUS AREA
  2881     0.17                          5891004473900  10.0   235   100  100.
*
* USS DUQUESNE
*
* BOILER #6
 290       0.84                          5985504469010  49.0   229   560 72.03 1.15
* BOILER #7
 291       0.84                          5985704469010  49.0   229   560 72.03 1.15
* BOILER #8
 292       0.84                          5985504469020  49.0   229   560 72.03 1.15
* BOILER #9
 293       0.84                          5985604469020  49.0   229   560 72.03 1.15
* BOILER #10
 294       0.84                          5985404469030  49.0   229   560 72.03 1.15
* BOILER #11
 295       0.84                          5985604469039  49.0   229   560 72.03 1.15
* BOILER #12
 296       0.76                          5985504469040  49.0   229   476 67.1  1.15
* BOILER #13
 297       0.76                          5985604469040  49.0   229   476 67.1  1.15
* BOILER #14
 298       0.76                          5985404469050  49.0   229   476 67.1  1.15
* BOILER #16
 299       0.76                          5985404469060  49.0   229   476 67.1  1.15
*
* USS NATIONAL REHEAT FURNACE   (ADD AS OF 10/05/79)
*
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300      2.00                         5972204467590  38.0   229   533  7.40  .68
*
*
*                  MONONGAHELA VALLEY SOURCES
*
*
* ARMCO STEEL
  417      7.45                       5652834495355  24.0   233   589 62.40  .91
* DUQUESNE LIGHT ELRAMA
  420   326.80                        5920004456200 119.0   229   430195.60 3.96
* WEST PENN. POWER MITCHELL
  426    30.00                        5873404452810  59.0   229   464113.30 2.13
  429    30.60                        5873404452810  59.0   229   422519.20 3.05
  430    25.20                        5873404452810  59.0   229   422519.20 3.05
  431   201.50                        5873404452810 107.0   229   422519.20 3.05
* WHEELING-PITTSBURGH STEEL MONESSEN
  432     1.60                        5939144446100  31.0   230   505  2.00  .61
  435     4.80                        5939144446100  38.0   230   666  7.00  .91
  440     1.60                        5946224446236  80.0   230   588 37.19 1.22
  441     3.90                        5948124446177  56.0   230   337106.10 1.25
  443     5.41                        5941704446350  34.1   230   450 48.97 1.98
  444     5.41                        5941904446350  34.1   230   450 48.97 1.98
  445     5.41                        5942204446350  34.1   230   450 33.46 1.98
  446     5.41                        5942404446350  34.1   230   450 33.46 1.98
  448     5.41                        5942904446350  34.1   230   450 33.46 1.98
* WHEELING-PITTSBURGH STEEL ALLENPORT
  450     5.50                        5987524437902  15.0   235   421  9.30  .22
  451    14.60                        5987524437902  61.0   235   575 64.90 1.52
* CALIFORNIA STATE COLLEGE
  454     1.80                        5952314435359  46.0   238   450  7.70 1.22
* ALLIED CHEMICAL
  460     3.20                        5946444436862   8.0   234   355 18.90  .50
* CORNING GLASS
  463     1.00                        5936544444158  15.0   233   477  1.76  .46
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*
*
*                    BEAVER VALLEY SOURCES
*
*
* J&L ALIQUIPPA
*
* BOILER #5,#58
 5001    37.17            5643304497350  46.6   219   533 75.28 1.30
* BOILER #6
 5002    51.95            5643104497560  76.2   232   485202.28 2.09
* NEW BOILER #6
 5003    34.07            5643104497560  61.0   232   473117.99 1.68
* A-1N. ST.
 5004     1.81            5645904497990  68.6   232   577 42.71 1.45
* A-1S. ST.
 5005     1.81            5646004497940  68.6   232   577 42.71 1.45
* A-5 ST.
 5006     4.16            5645904497790  76.2   232   577 19.66 1.68
* A-5N. REHEAT
 5007      .55            5645904497790  64.3   232   358 12.72  .56
* A-5S. REHEAT
 5008      .55            5645904497790  64.3   232   358 12.72  .56
* SOAKING PIT #2
 5009     1.30            5644204497590  53.3   232   922 13.92  .76
* SOAKING PIT #3
 5010     1.30            5644204497580  53.3   232   922 13.92  .76
* SOAKING PIT #4
 5011     1.30            5644204497570  53.3   232   922 13.92  .76
* SOAKING PIT #5
 5012     1.30            5644204497560  53.3   232   922 13.92  .76
* SOAKING PIT #6
 5013     1.30            5644204497550  53.3   232   922 13.92  .76
* SOAKING PIT #7
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 5014      1.30                          5644204497540  53.3   232   922 13.92  .76
* SOAKING PIT #8
 5015      1.30                          5644204497530  53.3   232   922 13.92  .87
* SOAKING PIT #9
 5016      1.30                          5644204497520  53.3   232   922 13.92  .87
* SOAKING PIT #10
 5017      1.30                          5643204497510  53.3   232   922 13.92  .87
* SOAKING PIT C
 5018      1.62                          5643204497490  53.3   232   922 17.40  .87
* SOAKING PIT P
 5019      1.62                          5643204497490  53.3   232   922 17.40  .87
* SOAKING PIT E
 5020      1.62                          5643204497480  53.3   232   922 17.40  .87
* SLAB FURNACE #1
 5021      2.29                          5644504497410  61.0   232   700 75.70 1.30
* SLAB FURNACE #2
 5022      2.29                          5644504497420  61.0   232   700 75.70 1.30
* A-2 SLTM FURNACE
 5023       .58                          5643204495640  38.1   232   977 14.68  .91
* 14" MILL REHEAT
 5024       .79                          5644704498000  38.1   232   700 13.70 1.25
* 30" ROD MILL FURNACE #1
 5025      1.03                          5642604494510  38.1   232   977 31.54  .87
* 30" ROD MILL FURNACE #2
 5026      1.03                          5642604494490  38.1   232   977 31.54  .87
* 30" ROD MILL FURNACE #3
 5027      1.03                          5642604494460  38.1   232   977 31.54 1.07
* 14" PIPE MILL FURNACE #1
 5028       .39                          5643204495710  38.1   232   977 12.82  .87
* 14" PIPE MILL FURNACE #2
 5029       .39                          5643204495720  38.1   232   977 12.82  .87
* 14" PIPE MILL FURNACE #3
 5030       .39                          5643204495750  38.1   232   977 12.82 1.07
* SL. ANNEX FURNACE #1
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 5031       .34                      5642704495720  27.4   232   700 11.28  .76
* SL. ANNEX FURNACE #2
 5032       .19                      5642704494750  27.4   232   422  3.75  .76
* ROD MILL FURNACE
 5033       .84                      5642404497950  38.1   232   811 28.01  .91
* TAIL GAS
 5034     12.16                      5645804497950  45.7   232   977  3.62  .53
* SOAKING PIT "A"
 5035      1.57                      5643204497490  53.3   232   922 17.40 1.14
* SOAKING PITS "B","F","G"
 5036      4.86                      5643204497490  53.3   232   922 17.40 1.14
* MEDUSA CEMENT
 5380     76.40                      5568744525270    91   244   589113.30 1.83
 5381      6.07                      5568744525270    40   244   560 53.00 1.68
*
* ARCO
*
* BOILER #1
 5384     33.82                      5546304500620    61   229   330 59.70 0.91
* BOILER #2
 5385     33.82                      5546304500620    61   229   330 59.70 0.91
* BOILER #3
 5386     33.82                      5546304500620    61   229   330 59.70 0.91
* OIL BOILER
 5388      4.64                      5546304500620    55   229   399 22.66 1.98
* B&W WALLACE RUN KTB #48,#49
 5391     14.40                      5552644515255    21   275   575 11.67 0.76
* B&W AMBRIDGE BOILERS #1,#2, KTB #63,#64
 5395      2.39                      5652834495355    26   233   450 23.40 1.14
* B&W TUBULAR PRODUCTS
 5398      5.66                      5564984513322    23   268   536 32.42 0.76
 5399      1.50                      5564984513322    21   268   577 16.06 0.91
* SHENANGO CHINA (INTERPACE)
 5402      3.20                      5537014539975    41   245   471  7.36 0.76
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*
* ASHLAND OIL
*
* CRUDE HEATER
 5404       .73                   5623154504580    34    229    477  6.45   .53
* CHARGE HEATER
 5405       .50                   5623154504580    18    229    477  4.15   .26
* BOILERS #1-3
 5406      3.17                   5623154504580    58    229    422 30.50 1.22
* VACUUM HEATER
 5407       .30                   5623154504580    34    229    477  2.28   .53
* NRV, RERUN & BRIGHT ST. HEATERS
 5408      1.10                   5623154504580    18    229    477  2.90   .26
* WESTINGHOUSE ELECTRIC BEAVER
 5413      8.34                   5575284486194    15    243    515 24.69 0.71
* HERCULES INC.
 5469      0.00                   5973514449231    15    232    533 11.16 0.46
*
* WEST PENN POWER WEST PITTSBURGH
*
* OPERATING @100%
 5472    353.90                   5531054531767   145    238    413961.50 4.00
* OPERATING @90%
 5473    318.51                   5531054531767   145    238    413865.35 4.00
* OPERATING @80%
 5474    283.12                   5531054531767   145    238    413769.20 4.00
* OPERATING @75%
 5475    265.43                   5531054531767   145    238    413721.13 4.00
* OPERATING @70%
 5476    247.73                   5531054531767   145    238    413673.05 4.00
* OPERATING @65%
 5477    236.60                   5531054531767   145    238    413663.37 4.00
* PENN POWER BRUCE MANSFIELD
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 5479   720.95                     5490494495067   250    219   341740.36 2.90
 5480   360.48                     5490494495067   183    219   341740.36 2.90

* ST. JOE MINERALS

* 275' STACK
 5512     88.45                    5552234501941    84    236   422 80.20 1.68
* 200' STACK
 5513 0     6.8                    5561604502218    61    236   347122.3  1.52
* 400' STACK
 5514 0  364.48                    5560654502301   122    236   336 213.7 2.74

* BESSEMER CEMENT

* UNIT #2
 5518 0    32.5                    5428604535850    67    320   477 51.4  1.68
* UNIT #2
 5519 0    49.3                    5428604535950    67    320   505 91.6  1.98

                  OTHER PENNSYLVANIA SOURCES

* ARMSTRONG POWER
 6021     520.0                    6289794531996  70.0    258   405 160.0 2.30
 6022     600.0                    6289794531996  70.0    258   439 285.0 2.30
* CARPENTERTOWN COAL
 6031      0.00                    6329974530998   5.0    274   9921177.4  .10
* KEYSTONE POWER
 6041    5198.9                    6401414502155 244.0    311   4091193.8 4.60
* HOMER CITY POWER
 6051    4752.4                    6527564486147 244.0    366   405 967.6 4.70
* CONEMAUGH POWER
 6061    4712.3                    6645824471929 305.0    330   4091194.0 4.10
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* SEWARD POWER
 6071    854.0                  6668824474602  69.0   332   414 207.0 1.50
 6072      0.0                  6668824474602  69.0   332   450 126.7 1.20
* HATFIELD POWER
 6081   5792.5                  5915704412040 213.4   220   411 935.0 3.45
* AVERTON FUEL
 6091      3.2                  6192894443933   5.0   334   922 221.3  .10
 6092      6.9                  6205444443891   5.0   334   922  88.5  .10
* SLIPPERYROCK COLLEGE
 6101     31.2                  5798254545763  53.0   412   505  25.6  .90
* SUNNEBORN
 6111     58.3                  6077764540569  61.0   366   505  15.8 1.25
* SHENLEY DISTILLERS
 6121     27.1                  6134204505200  24.0   251   477   7.4  .80
*
*
*                    EASTERN OHIO SOURCES
*
*     NOTE: 1975 EMISSIONS DATA WERE USED FOR THE NON-POWER GENERATING
*           SOURCES DUE TO A LACK OF COMPLIANCE DATA.
*           COMPLIANCE DATA FOR THE OHIO POWER STATIONS WAS OBTAINED
*           FROM EPA REGION III.
*           REVISED BY REGION III:  05 NOVEMBER 79
*           (CONVERSATIONS WITH OHIO & REGION V)
*
*
*
* FEDERAL PAPERBOARD
 8003    153.0                 5332004468900    71   256   644 45.95 1.50
* KAOL CLAY
 8011      5.90                5330004481300    46   283   421  1.41 1.51
* OHIO POWER TORONTO          (REVISED 11/5/79)
 8023   1894.0                 5335004481800   198   201   441368.40 2.29
* OHIO EDISON SAMMIS          (REVISED 11/5/79)
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```
 8031     970.0                   5317004485500   154    210    405598.03 3.20
 8032     970.0                   5317004485500   154    210    405619.21 3.05
 8035    2424.0                   5317004485500   259    210    405507.11 4.76
 8036    1616.0                   5317004485500   305    210    4051050.9 4.09
* OHIO EDISON BURGER
 8041    3987.0                   5205004417500   259    198    4661088.0 3.30
* OHIO EDISON TIDD                 (SHUT DOWN)
 8051       0.0                   5299004455700    75    207    455 99.10 1.50
 8052       0.0                   5299004455700    75    207    455 99.10 1.50
 8053       0.0                   5299004455700    75    207    455234.91 2.15
* CARDINAL POWER                (REVISED 11/5/79)
 8061    1223.0                   5300004455800   252    198    447897.84 3.36
 8062    1223.0                   5300004455800   252    198    447897.84 3.36
 8063     708.0                   5300004455800   274    204    4301025.5 3.66
* TORONTO PAPERBORD
 8071       8.5                   5337004480200    20    215    394 15.23 1.05
* NATIONAL STEEL WEIRTON DIVISION
 8081      14.80                  5327004467000    51    204    516 11.12  .85
 8082      14.80                  5327004467000    51    204    516 11.12  .85
 8083      14.80                  5327004467000    51    204    516 11.12  .85
 8084      14.80                  5327004467000    51    204    516 11.12  .85
* WHEELING-PITTSBURGH NORTH PLANT
 8091     138.5                   5325004466700    84    204    589 44.49 1.70
 8092      80.7                   5325004466700    39    204    505 26.24 1.20
 8093      80.7                   5325004466700    39    204    505 26.24 1.20
 8094      80.7                   5325004466700    39    204    505 26.24 1.20
 8095      35.3                   5325004466700    50    204    533 27.04  .75
 8096      35.3                   5325004466700    50    204    644  3.12 1.05
 8097      35.3                   5325004466700    50    204    644  6.23 1.05
 8098      35.3                   5325004466700    50    204    644  6.23 1.05
 8099      35.3                   5325004466700    50    204    644  3.71  .75
* WHEELING-PITTSBURGH SOUTH PLANT
 8121      94.4                   5346004463300    91    204    589 58.99 2.35
 8122      37.0                   5346004463300    49    204    519 12.57 1.00
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  8123      36.6                    5346004463300    49    204    519 12.57 1.00
  8124      34.3                    5346004463300    49    204    519 12.57 1.00
  8125      34.3                    5346004463300    49    204    519 12.57 1.00
  8126      34.3                    5346004463300    49    204    519 12.57 1.00
  8127      34.3                    5346004463300    49    204    519 12.57 1.00
  8128      49.8                    5346004463300    49    204    547 13.51 1.00
  8129      49.8                    5346004463300    49    204    547 13.51 1.00
  8130      18.8                    5346004463300    49    204    644  3.82  .90
  8131      18.8                    5346004463300    33    204    644  3.82  .90
  8132      18.8                    5346004463300    50    204    700  3.82  .90
  8133      18.8                    5346004463300    50    204    700  3.82  .90
  8134      18.8                    5346004463300    50    204    700  3.82  .90
* WHEELING-PITTSBURGH YORKVILLE
  8141     102.8                    5254004445400    63    205    422  6.01 1.80
  8142     120.5                    5254004445400    63    205    422  6.01 1.80
* WHEELING-PITTSBURGH MARTINS FERRY
  8151      47.4                    5247004439200    24    202    510  1.13  .60
  8152     142.5                    5247004439200    38    202    516  7.07 1.50
* CRUCIBLE STEEL MIDLAND
  8171       3.9                    5150004396500    18    195    589  5.08 0.60
  8172      47.6                    5150004396500    18    195    297  7.85 0.70
  8173       1.5                    5150004396500    21    195    589 15.81 0.44
  8174       0.8                    5150004396500     6    195    589  8.30 0.75
* OHIO EDISON EAST PALESTINE          (SHUT DOWN)
  8161       0.0                    5359004520300    30    314    561 38.17 1.50
  8162       0.0                    5359004520300    29    314    561 26.15  .75
  8163       0.0                    5359004520300    58    314    561 26.15  .75
*
*
*                 WEST VIRGINIA SOURCES
*
*     NOTE: WEST VIRGINIA EMISSIONS DATA WERE OBTAINED FROM DATA
*           PROVIDED BY WEST VIRGINIA AND REGION X:  1978A
*     NOTE: REVISED BY REGION III:  05 NOVEMBER 1979
*           COMMUNICATION WITH WEST VIRGINIA
*
*
* ALLIED CHEMICAL
*   01,02 COAL-FIRED BOILERS      (REVISED 11/5/79)
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 9001     18.0                   5167004417000    31    203    299  6.20 1.00
*    #3,#4 COAL-FIRED BOILERS      (REVISED 11/5/79)
 9002     30.0                   5167004417000    31    203    293  6.50 1.30
*    NORTH PLANT COAL-FIRED BOILERS
 9003     12.9                   5167004417000    20    203    800 15.00 1.00
* BANNER FIBREBOARD
*    TWO OIL-FIRED BOILERS
 9011     14.0                   5333004458800     7    204    575 11.70  .50
* BLAW-KNOX PENINSULA PLANT
*    #3 OPEN HEARTH
 9021      2.1                   5239004436400    40    201    755  9.49  .58
* CITY SERVICE
*    #1 REACTOR
 9042      1.2                   5115004398700    23    204    507 19.20  .46
*    #2 REACTOR
 9043      1.2                   5115004398700    23    204    507 12.60  .57
*    #3 REACTOR
 9044      1.5                   5115004398700    24    204    507 14.90  .61
*    #4 REACTOR
 9045      1.5                   5115004398700    24    204    507 14.90  .61
* DIECKMANN & SONS
*    THREE COAL-FIRED BOILERS
 9050      8.5                   5308004434000    25    209    633 11.20  .60
* GLOBE REFRACTORY
*    #5A TUNNEL KILN
 9061     40.0                   5319004495700    12    207    533 21.40  .73
*    #5B TUNNEL KILN
 9062     40.0                   5319004495700    12    207    533 21.40  .73
*    #4 TUNNEL KILN
 9063     10.0                   5319004495700    11    207    583  7.15  .73
*    #2 TUNNEL KILN
 9064      6.4                   5319004495700     6    207    516  3.46  .43
* H B REED
 9071       .1                   5159004407400    12    204    327  6.68  .42
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* KAMMER POWER
 9081   2770.0                       5153204410320   183    197    442613.10 2.38
 9082   1385.0                       5153304410330   183    197    442305.90 1.68
* KOPPERS
*   #2 COAL/OIL-FIRED BOILER       (REVISED 11/5/79)
 9091     10.0                       5334004465500    61    204    589 30.90 1.55
*   #3 COAL/OIL-FIRED BOILER       (REVISED 11/5/79)
 9092     10.0                       5334004465500    44    204    589 18.40 1.07
*   #4 COAL-FIRED BOILER           (REVISED 11/5/79)
 9093     36.0                       5334004465500    58    204    477 25.20  .68
*   F2 FLARE                       (REVISED 11/5/79)
 9095     33.0                       5334004465000    15    204    789  2.58  .38
*   H2S FLARE                      (REVISED 11/5/79)
 9096       .5                       5334004465000    21    204   1144  1.60  .08
*   #5 COAL-FIRED BOILER
 9097     50.0                       5334004465000    61    204    477 35.7  1.55
* MITCHELL POWER
 9101   9289.0                       5158004408670   366    210    4412410.0 5.03
* MOMBAY CHEMICALS
*   #9,#10 OIL-FIRED BOILERS       (REVISED 11/5/79)
 9111    135.2                       5147004397200    15    199    452 14.28  .88
* OHIO VALLEY MEDICAL CENTER
*   THREE COAL/OIL-FIRED BOILERS
 9131      4.6                       5238004434300    38    219    633  4.75 1.10
* PPG
*   #4 COAL-FIRED BOILER           (REVISED 11/5/79)
 9141    190.0                       5126004399600    69    200    450 79.70 2.45
*   #5 COAL-FIRED BOILER           (REVISED 11/5/79)
 9142    340.0                       5126004399600    91    200    436123.60 1.35
*   SULFUR RECOVERY
 9143     45.0                       5127004399800    31    207    477  2.36  .38
* QUAKER STATE REFINERY
*   #1 OIL-FIRED BOILER            (REVISED 11/5/79)
 9151     26.0                       5309004496200    46    207    561 37.70  .91
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*   #2 OIL-FIRED BOILER           (REVISED 11/5/79)
 9152      26.0                    5309004496200    46    207    561 37.70   .91
*   #3 OIL-FIRED BOILER           (REVISED 11/5/79)
 9153      26.0                    5309004496200    46    207    561 37.70   .91
*   H-101 CRUDE HEATER
 9154      12.0                    5309004496200    38    207    522  7.10   .46
*   PLATEFORMER
 9155       6.0                    5309004496200    38    207    533 10.20   .84
*   150 HEATER
 9156       4.0                    5309004496200    38    207    700  7.90   .91
*   WASTE GAS FLARE
 9157      12.0                    5309004496200    67    207    866   .05   .70
* ST. GEORGE
*   TWO COAL-FIRED BOILERS
 9161       3.8                    5329004458200    24    204    633   .50   .53
* TAYLOR SMITH & TAYLOR
*   TWO COAL-FIRED BOILERS
 9181       7.2                    5373004496300    38    207    477  4.67   .57
* TRIANGLE CONDUIT
*   THREE COAL-FIRED BOILERS
 9191      21.5                    5209004420300    24    207    586  8.80   .57
* US STAMPING
*   TWO COAL-FIRED BOILERS
 9201       5.6                    5225004419400    24    209    421  1.32   .54
* VALLEY CAMP COAL #1
*   #2 THERMAL DRYER
 9211       5.5                    5308004444800    23    255    394 54.10  2.55
*   #1 THERMAL DRYER
 9212       5.5                    5308004444800    26    255    394 45.20  1.10
* VALLEY CAMP COAL #3
*   #1 THERMAL DRYER
 9221       2.8                    5333004434600    24    248    394 15.10   .91
*   #2 THERMAL DRYER
 9222       1.7                    5333004434600    26    248    394  9.10   .91
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*
* NATIONAL STEEL
*
* BROWNS ISLAND COKE
*   BATTERY UNDERFIRE
 9231     18.6                   5333004474800    76    232    533 53.60 2.06
*   GAS FLARE
 9232      2.0                   5333004474800    42    232    866 19.20  .38
*   BATTERY AREA
 92331      .3                   5333004474800    25    232    100   100
* MAINLAND COKE
*   BATTERY #5 UNDERFIRE
 9252      9.1                   5338004474600    76    232    555 19.20 1.37
*   BATTERY #6 UNDERFIRE
 9253      9.1                   5338004474600    76    232    555 19.20 1.37
*   BATTERY #7 UNDERFIRE
 9254     10.6                   5338004474600    76    232    555 22.40 1.68
*   BATTERY #8,#9 UNDERFIRE
 9255     14.0                   5338004474600    76    232    555 14.94 1.30
*   BATTERY AREA
 92571     3.8                   5338004474600    18    232    100   100
*
* NATIONAL STEEL WEIRTON DIVISION
*
*   #2 WIND BOX
 9262     89.0                   5343004474100    49    232    422257.00 2.29
* WHEELING HOSPITAL
*   COAL-FIRED BOILERS
 9271      1.5                   5234004436800    35    207    633  2.16  .91
* WHEELING-PITTSBURGH STEEL BENWOOD
*   #1,#2 COAL BOILERS
 9281      3.9                   5229004430200    21    198    450 10.00  .66
*   DESULFURIZATION
 9285     15.0                   5335004465600    26    204    335  3.30  .30
*   #8 BATTERY UNDERFIRE
 9286     13.0                   5335004465600    76    204    422 43.10 1.98
*   #4,#5 BOILERS              (REVISED 11/5/79)
```

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 9287    135.0                   5335004465900    17    204    426 14.20   .60
* WHEELING-PITTSBURGH FOLLENSBEE PLANT
*
*   #1 BATTERY UNDERFIRE
 9291      2.5                   5335004465900    61    204    616 19.90 1.26
*   #2 BATTERY UNDERFIRE
 9292      2.5                   5335004465800    61    204    616 19.90 1.26
*   #3 BATTERY UNDERFIRE
 9293      2.8                   5335004465700    69    204    616 22.40 1.22
*   #1-3,#8 AREA SOURCES
 92971     3.4                   5335004465600    18    204    100   100
*   #1 STRAND WIND BOX
 9301     18.7                   5335004465200    30    204    325 81.80 1.22
*
* NATIONAL STEEL WEIRTON DIVISION
*
*   #1-3 COAL-FIRED BOILERS
 9341    540.0                   5343004474400    43    204    505118.20 1.52
*   #4 COAL-FIRED BOILER       (REVISED 11/5/79)
 9344    103.0                   5343004474400    43    204    505118.00 1.52
*   #5 COG-FIRED BOILER        (REVISED 11/5/79)
 9345    170.0                   5343004474400    55    204    505 91.40 1.68
*    P1,P2 GAS BOILERS         (REVISED 11/5/79)
 9346     86.0                   5343004474400    67    204    505 76.00 2.30
*   #15 COG BOILER
 9351     16.0                   5343004474400    67    204    530 96.00 2.30
*   #6,#7 HEAT EXCHANGER
 9352     22.0                   5348004473800    61    204    333118.00 2.70
*   60 T REHEAT
 9353      2.6                   5350004473000    46    204    540  4.20 1.06
*   #1-4 REHEATS              (REVISED 11/5/79)
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 9354     107.9                            5350004473000    61    204    520 41.60 1.45
*   #1,#2 SPELTERS
 9355       2.3                            5350004472900    40    204    650  5.00   .86
*   #3,#4 SPELTERS
 9356       1.5                            5350004472900    26    204    650  2.37   .44
*   ANNEALING FURNACE
 9357        .2                            5350004473000    29    204    480   .56   .69
*   #1-12 ANNEALING FURNACES
 9358        .6                            5350004473000    15    204    480   .22   .17
*   TIN MILL
 9359       1.5                            5350004473000    30    204    420  1.10 1.07
*   BLOOMING FURNACE
 9360      19.6                            5350004473000    53    204    505  4.78   .95
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APPENDIX C.3

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     ALLEGHENY COUNTY 1976/1977 EMISSIONS INVENTORY FOR VALIDATION STUDY

SOURCE  SOURCE STRENGTH G/S               UTM          HT     ELE   TEMP.   VOL.  R
  NO.   ANNUAL SEA 2 SEA 3 SEA 4     X         Y      (M)    (M)    K     M3/S (M)

      ALLEGHENY COUNTY SOURCES AS SUPPLIED BY ACBAPC/TRC

 PITTSBURGH BREWING
   1      7.50    7.50    7.50    7.50 5875504479280  58.0    226    488  16.9 1.60
 KOPPERS
   2      2.44    2.44    2.44    2.44 5744004468100  28.6    250    533  34.1  .62
   3      2.44    2.44    2.44    2.44 5744004468100  28.6    250    637  18.4  .76
 12TH STREET STEAM PLANT
   4     14.10   14.10   14.10   14.10 5852004477600  82.0    221    604 265.5 2.20
 WEST PENN POWER SPRINGDALE
   5      6.70    6.70    6.70    6.70 6043804488740  64.3    227    472 185.5 2.44
   6     16.50   16.60   16.60   16.60 6043804488740  64.3    227    444 192.7 1.85
 DUQUESNE LIGHT CHESWICK
   7  1568.101568.101568.101568.10 6023304487800 229.0    229    5581024.6 3.20
 SATELLITE ALLOY                       (BILL MUER  6/8/79)
  81    21.17   21.17   21.17   21.17 6042004488500  10.0    229     51    51
 EDGE STEEL
   9      1.20    1.20    1.20    1.20 5976004485200  38.1    220    348  21.8  .76
 DUQUESNE LIGHT BRUNOT ISLAND
  10      9.87    9.87    9.87    9.87 5806804479680  10.0    222    735 248.6 2.06
  11      9.87    9.87    9.87    9.87 5806804479680  19.2    222    467 333.7 1.91
 MARQUET CEMENT
  12     47.80   47.80   47.80   47.80 5783004482600  46.0    222    491  94.0 1.90
 SHENANGO BATTERIES 82,83
  13     37.80   37.80   37.80   37.80 5780504483110  76.0    222    588 106.0 1.05
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SHENANGO BATTERY #4
 14     24.00  24.00  24.00   24.00 5780504483110  69.0   222   478  62.0 1.05
SHENANGO BOILERS #7,#8
 15     18.20  18.20  18.20   18.20 5783304482800  26.0   222   452  38.0  .90
SHENANGO BOILER #9
 16     34.92  34.92  34.92   34.92 5783604482790  38.7   222   627 155.0 1.50
VULCAN MATERIALS
 17      2.47   2.47   2.47    2.47 5748004484600  20.3   223   553  10.2  .50
 18      2.47   2.47   2.47    2.47 5748004484600  17.2   223   553   2.4  .50
PITTSBURGH ACTIVATED CARBON
 19      2.15   2.15   2.15    2.15 5781004482500  12.2   223   533    .7  .20
 20      2.80   2.80   2.80    2.80 5781004482500  18.9   223  1255   5.3  .38
 21      1.30   1.30   1.30    1.30 5781004482500  17.8   223  1144  25.0  .52
ALCOSAN
 22      6.70   6.70   6.70    6.70 5814004480800  91.4   230   344  23.5 1.22
DUQUESNE LIGHT PHILLIPS POWER STATION
 23   570.20 570.20 570.20 570.20 5652604491020 104.0   226   322 340.4 3.96
ARMCO
 68     18.90  18.90  18.90   18.90 5652804495350  24.0   233   588 27.39  .91
GAVLICK
 69      6.90   6.90   6.90    6.90 5647004491860  12.0   229   365 56.28  .30
DRAVCO
 70      1.10   1.10   1.10    1.10 5786004482600  25.6   226   416  20.7  .75
USS CHEMICAL NEVEL ISLAND
 71      2.00   2.00   2.00    2.00 5780004483000  30.5   223   322   5.6  .30
 72      0.10   0.10   0.10    0.10 5779004483700  12.2   223   541  18.8  .60
NEVEL CHEMICALS
 73      4.20   4.20   4.20    4.20 5764004483700  12.0   223   573   8.0  .61
 74      0.60   0.60   0.60    0.60 5764004483700  14.0   223   543   6.8  .61
BLAWNOX
 75      0.80   0.80   0.80    0.80 5878004480400  22.3   223   352  14.6  .55
 76      0.50   0.50   0.50    0.50 5878004480400  22.3   223   352  10.7  .55
 77      1.10   1.10   1.10    1.10 5878004480400  22.3   223   352   9.9  .55
HAHN
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 78      1.20    1.20    1.20    1.20 5862004484900   47.2    329    394  10.8  .60
BLTZHVR
 79      0.30    0.30    0.30    0.30 5848004474400   18.3    305    408   1.0  .50
PERRY
 80      2.60    2.60    2.60    2.60 5831004482300   18.3    354    408  10.3  .50
OVERBROOK
 81      0.20    0.20    0.20    0.20 5851004471200   18.3    280    408    .9  .50
S. HILLS
 82      1.90    1.90    1.90    1.90 5844004475000   18.3    335    408   7.5  .50
21ST STREET STEAM PLANT
 83      0.10    0.10    0.10    0.10 5864004478100   18.3    268    408    .8  .50
MORSE
 84      0.30    0.30    0.30    0.30 5874004475500   18.3    229    408   1.0  .50
LATIMER
 85      1.90    1.90    1.90    1.90 5846004478700   18.3    244    408   3.7  .50
MCKEYSPORT HOSPITAL
 86      1.30    1.30    1.30    1.30 5990004466600   27.4    274    408   5.4  .70
 87      0.30    0.30    0.30    0.30 5965004466900   18.3    238    408   1.2  .50
ST. JOSEPH'S HOSPITAL
 88      0.30    0.30    0.30    0.30 5816004480900   40.0    238   .408   3.9  .55
PPG
 89      0.60    0.60    0.60    0.60 6044004494200   73.2    274    514  18.7 1.85
 90      0.50    0.50    0.50    0.50 6044004494200   39.2    274    514  10.1  .90
GLASSMERE
 91      0.10    0.10    0.10    0.10 6036004492500   15.2    229    644   6.2  .60
DUQUESNE MANSFIELD
 92      0.30    0.30    0.30    0.30 5821004478900   12.2    232   1033   3.9  .45
SHENANGO COKE OVEN
 941     3.39    3.39    3.39    3.39 5782204482540   10.0    222    100   100
SHENANGO BOILER #10
 95     00.00   00.00   00.00   00.00 5783904483030   33.5    222   477142.79 1.50

USS CLAIRTON                    (B BLOOM UPDATE 6/8/79)
BATTERY #1
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110      6.40    6.40    6.40    6.40 5958954461555  69.0   229   588  37.4 1.22
BATTERY #2
111      6.40    6.40    6.40    6.40 5958804461565  69.0   229   588  37.4 1.22
BATTERY #3
112      6.40    6.40    6.40    6.40 5957454461715  69.0   229   588  37.4 1.22
BATTERY #4
113      5.90    5.90    5.90    5.90 5959254461585  65.0   229   575  35.6 1.27
BATTERY #5
114      5.90    5.90    5.90    5.90 5958704461680  65.0   229   575  35.6 1.27
BATTERY #6
115      5.90    5.90    5.90    5.90 5957854461750  65.0   229   575  35.6 1.27
BATTERY #7
116      3.80    3.80    3.80    3.80 5956904461865  69.0   229   575  33.4 1.22
BATTERY #8
117      3.80    3.80    3.80    3.80 5956854461875  69.0   229   575  33.4 1.22
BATTERY #9
118      3.80    3.80    3.80    3.80 5955454462045  69.0   229   575  33.4 1.22
BATTERY #10
119      4.10    4.10    4.10    4.10 5955104462090  69.0   229   575  34.7 1.52
BATTERY #13
120      3.80    3.80    3.80    3.80 5953604461925  61.0   229   575  45.9 1.50
BATTERY #14
121      3.80    3.80    3.80    3.80 5953504461935  61.0   229   575  45.9 1.50
BATTERY #15
122      3.80    3.80    3.80    3.80 5952154462105  61.0   229   575  45.9 1.50
BATTERY #16
123      3.80    3.80    3.80    3.80 5951894462140  76.0   229   575 45.65 1.70
BATTERY #17
124      3.80    3.80    3.80    3.80 5950854462250  76.0   229   575 45.65 1.70
BATTERY #19
125      3.70    3.70    3.70    3.70 5952254461875  76.0   229   577  50.4 2.14
BATTERY #20
126      7.30    7.30    7.30    7.30 5952104461895  76.0   229   577  50.4 2.14
BATTERY #21
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127       7.30   7.30   7.30   7.30 5951104462140  76.0   229   575  51.5 2.14
BATTERY #22
128       7.30   7.30   7.30   7.30 5949954462160  76.0   229   575  51.5 2.14
TAIL GAS
129      27.90  27.90  27.90  27.90 5957154461695  46.0   223   561  18.0  .61
REHEAT MILLS
130       4.10   1.25   1.25   1.25 5958714461000  18.0   224   811  70.0  .70
REHEAT MILLS
131       4.10   1.25   1.25   1.25 5958674460980  18.0   224   811  70.0  .70
REHEAT MILLS
132       5.90   2.00   2.00   2.00 5960094460924  30.5   224   811  70.0  .60
REHEAT MILLS
133       5.90   2.00   2.00   2.00 5959964460929  30.5   224   811  70.0  .60
REHEAT MILLS
134       5.90   2.00   2.00   2.00 5959824460933  30.5   224   811  70.0  .60
REHEAT MILLS
135       5.90   2.00   2.00   2.00 5959694460930  30.5   224   811  70.0  .60
REHEAT MILLS
136       4.60   1.43   1.43   1.43 5958334461020  25.9   226   811  11.8  .65
REHEAT MILLS
137       4.60   1.43   1.43   1.43 5958274461004  25.9   226   811  11.8  .65
REHEAT MILLS
138       4.60   1.43   1.43   1.43 5958224460991  25.9   226   811  11.8  .65
REHEAT
139       2.20   0.72   0.72   0.72 5959874460973  25.9   226   811   5.5 0.65
REHEAT
140       2.20   0.72   0.72   0.72 5959734460962  25.9   226   811   5.5 0.65
BOILERS
141     147.55  70.24  70.24  70.24 5949584462545  50.0   226   478  91.7 1.33
BOILERS
142      79.00  37.50  37.50  37.50 5949334462564  50.0   226   478  80.4 1.06
BOILERS
143      21.80  10.40  10.40  10.40 5947604462427  27.0   226   613  62.3 1.14
BOILERS
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144     22.00  10.50  10.50   10.50 5947894462402  27.0   226   613  62.3 1.14
BOILERS
145     54.20  25.74  25.74   25.74 5948004462400  50.0   227   444  48.8 1.52

USS DUQUESNE                 (B BLOOM UPDATE 6/7/79)
SOAKING PITS
146      3.77   3.77   3.77    3.77 5981874470077  54.9   229   600  23.9 1.20
SOAKING PITS
147      3.77   3.77   3.77    3.77 5982104470053  54.9   229   600  23.9 1.20
SOAKING PITS
148      3.77   3.77   3.77    3.77 5982324470025  54.9   229   600  23.9 1.20
SOAKING PITS
149      3.77   3.77   3.77    3.77 5982554469998  54.9   229   600  23.9 1.20
HEAT TREATING
1501    15.30   5.34   5.34    5.34 5978834470353  10.0   229   100   100
REHEAT FURNACE
151      3.91   1.80   1.80    1.80 5978974470169   8.0   229   811  12.5  .62
REHEAT FURNACE
152      3.91   1.80   1.80    1.80 5979044470162   8.0   229   811  12.5  .62
REHEAT FURNACE
153      2.78   1.28   1.28    1.28 5978844470162  37.0   229   589   8.8  .90
REHEAT FURNACE
154      2.78   1.28   1.28    1.28 5978734470143  37.0   229   589   8.8  .90
REHEAT FURNACE
155      2.78   1.28   1.28    1.28 5978844470129  37.0   229   589   8.8  .90
156      9.96   4.68   4.68    4.68 5979004470160  28.4   229   699  31.5  .69
BOILER
157     12.53   5.52   5.52    5.52 5985624469030  49.0   229   478  33.4 1.15
BOILER
158     12.53   5.52   5.52    5.52 5985434469062  49.0   229   478  33.4 1.15

USS NATIONAL                 (B BLOOM UPDATE 6/7/79)
SINTER PLANT
159      4.67   4.67   4.67    4.67 5977204467400  27.4   229   330   3.4  .94
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SOAKING PITS
160      1.50    0.57    0.57    0.57 5976804467485  27.0   229   616   4.9  .62
SOAKING PITS
161      1.50    0.57    0.57    0.57 5976904467490  27.0   229   616   4.9  .62
SOAKING PITS
162      1.50    0.57    0.57    0.57 5977104467492  27.0   229   616   4.9  .62
SOAKING PITS
163      1.50    0.57    0.57    0.57 5977154467493  27.0   229   616   4.9  .62
SOAKING PITS
164      1.50    0.57    0.57    0.57 5977304467494  27.0   229   616   4.9  .62
SOAKING PITS
165      1.50    0.57    0.57    0.57 5977454467495  27.0   229   616   4.9  .62
SOAKING PITS
166      1.77    0.66    0.66    0.66 5977604467497  27.0   229   616   5.9  .62
SOAKING PITS
167      1.77    0.66    0.66    0.66 5977704467498  27.0   229   616   5.9  .62
SOAKING PITS
168      1.77    0.66    0.66    0.66 5977854467499  27.0   229   616   5.9  .62
SOAKING PITS
169      1.77    0.66    0.66    0.66 5977974467500  27.0   229  .616   5.9  .62
ROTARY
170     19.89    8.00    8.00    8.00 5967444467549  38.0   229  1089  98.5  .88
HEAT FURNACE
171      6.11    2.50    2.50    2.50 5966664467575  38.0   229   533  30.6  .76
HEAT FURNACE
172      6.11    2.50    2.50    2.50 5966684467563  38.0   229   533  30.6  .76
REHEAT FURNACE
173      1.44    0.59    0.59    0.59 5967814467574  38.0   229   533   7.4  .68
REHEAT FURNACE
174      1.44    0.59    0.59    0.59 5967994467578  38.0   229   533   7.4  .68
REHEAT FURNACE
175      1.44    0.59    0.59    0.59 5969324467442  38.0   229   533   7.4  .68
NORMALIZER
176      1.44    0.59    0.59    0.59 5969254467478  14.0   229   533   1.0  .25
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NORMALIZER
177       0.44    0.16     0.16     0.16 5970754467532  14.0   229   477  16.9  .65
WALKING FURNACE
178       1.67    0.67     0.67     0.67 5967044467557  30.5   229   866   7.8  .68
WARN FURNACE
1791      3.77    1.55     1.55     1.55 5972404467600  10.0   229   100   100
BOILERS
180       7.54    3.15     3.15     3.15 5972154467595  44.7   221   635 101.5 1.34
BOILERS
181       7.54    3.15     3.15     3.15 5972154467580  44.7   221   635 101.5 1.34
BOILERS
182       7.54    3.15     3.15     3.15 5972254467580  44.7   221   635 101.5 1.34
BOILERS
183       7.54    3.15     3.15     3.15 5972254467595  44.7   221   635 101.5 1.34
BOILERS
184       7.54    3.15     3.15     3.15 5974004467330  44.7   221   635 101.5 1.34

USS IRVIN
SLAB HEATING
185      13.40   13.40    13.40    13.40 5931454465680  21.3   283   450  46.7 1.30
SLAB HEATING
186      13.40   13.40    13.40    13.40 5931504465628  21.3   283   450  46.7 1.30
SLAB HEATING
187      13.40   13.40    13.40    13.40 5931554465693  21.3   283   450  46.7 1.30
SLAB HEATING
188      13.40   13.40    13.40    13.40 5931574465710  21.3   283   450  46.7 1.30
SLAB HEATING
189      13.40   13.40    13.40    13.40 5931564465725  21.3   283   450  46.7 1.50
BOILERS
190      13.34    8.27     8.27     8.27 5932134465750  32.0   283   643 109.0 1.52
BOILERS
191      30.97   19.31    19.31    19.31 5932194465765  32.0   283   643 115.6 1.52
BOILERS
192      17.75   11.04    11.04    11.04 5932104465712  26.5   283   455  42.5  .91
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USS CLAIRTON
BATTERY B
193      0.00    0.00    0.00    0.00 5956804461900  83.8   229   575  80.01  2.74
BATTERY C
194      0.00    0.00    0.00    0.00 5955004462100  83.8   229   575  80.01  2.74
BOILERS T1,T2
195      2.80    0.00    0.00    0.00 5947704462400  26.5   226   444  20.93   .73

USS NATIONAL
TEMPERING
1961     0.50    0.50    0.50    0.50 5967044467557  10.0   229   100   100
DUQUESNE LIGHT STANWIX
201      8.60    8.60    8.60    8.60 5843804477300  97.5   220   574 217.2  2.40
H J HEINZ
202      3.60    3.60    3.60    3.60 5860004478900  76.0   222   464  70.3  1.50
203      8.80    8.80    8.80    8.80 5860004478900  76.0   222   464 103.1  1.50
WESTINGHOUSE ELECTRIC
204      1.40    1.40    1.40    1.40 5990204472550  37.1   308   466  23.4   .99
BELLEFIELD BOILERS
205     16.10   16.10   16.10   16.10 5891904477100  59.4   256   589  49.6  1.40
206     16.10   16.10   16.10   16.10 5891904477100  77.7   256   517  91.9  1.70
WABCO.
207      3.80    3.80    3.80    3.80 5944004475550  27.0   274   569  19.3   .70
MESTA MACHINE
208      0.10    0.10    0.10    0.10 5909204471980  61.0   229   393  18.8   .90
B&O RAILROAD
209      3.30    3.30    3.30    3.30 5898004472500  38.0   230   533  99.6  1.06
UNIVERSAL ATLAS
210     52.20   52.20   52.20   52.20 6003004479400  16.7   371   513 202.5  1.10

USS HOMESTEAD
OPEN HEARTH
211     12.90   12.90   12.90   12.90 5924504473650  37.0   229   533  94.0  1.98
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212     12.90  12.90  12.90   12.90 5924754473685  37.0   229   533  94.0 1.98
213     12.90  12.90  12.90   12.90 5925104473750  37.0   229   533  94.0 1.98
214     12.90  12.90  12.90   12.90 5925204473760  37.0   229   533  94.0 1.98
215     12.90  12.90  12.90   12.90 5925504473820  37.0   229   533  94.0 1.98
SOAKING PITS
216      1.93   1.00   1.00    1.00 5918954473025  37.0   229   533   6.5  .84
217      1.93   1.00   1.00    1.00 5919004473035  37.0   229   533   6.5  .84
218      1.93   1.00   1.00    1.00 5919034473045  37.0   229   533   6.5  .84
219      1.93   1.00   1.00    1.00 5919054473050  37.0   229   533   6.5  .84
220      3.63   1.89   1.89    1.89 5919104473060  31.0   229   533  10.0  .76
221      3.63   1.89   1.89    1.89 5919134473070  31.0   229   533  10.0  .76
222      3.63   1.89   1.89    1.89 5919154473080  31.0   229   533  10.0  .76
223      3.63   1.89   1.89    1.89 5919204473090  31.0   229   533  10.0  .76
224      3.63   1.89   1.89    1.89 5919254473100  31.0   229   533  10.0  .76
225      3.63   1.89   1.89    1.89 5919304473110  31.0   229   533  10.0  .76
226      3.63   1.89   1.89    1.89 5919354473120  31.0   229   533  10.0  .76
227      3.63   1.89   1.89    1.89 5919404473130  31.0   229   533  10.0  .76
228      3.63   1.89   1.89    1.89 5919504473140  31.0   229   533  10.0  .76
229      3.63   1.89   1.89    1.89 5919604473150  31.0   229   533  10.0  .76
230      3.63   1.89   1.89    1.89 5919654473160  31.0   229   533  10.0  .76
231      3.63   1.89   1.89    1.89 5919704473170  31.0   229   533  10.0  .76
232      2.25   1.80   1.80    1.80 5919754473180  44.0   229   533   7.5 1.05
233      9.77   5.10   5.10    5.10 5931084473742  50.0   230   533 117.2  .84
234      9.77   5.10   5.10    5.10 5930924473742  50.0   230   533 117.2  .84
36" MILL
235     10.20  10.20  10.20   10.20 5932254473733  23.0   230   477  28.5  .40
236      3.00   3.00   3.00    3.00 5932254473755  35.0   230   477   8.8  .76
BLACK SMITH
237     14.14   6.76   6.76    6.76 5934254474000  23.0   227   477  12.0  .38
100" REHEAT FURNACE
238     32.14  15.27  15.27   15.27 5918874473270  38.0   227   477  17.2  .80
NORMALIZER
2391     2.52   1.20   1.20    1.20 5918874473270  10.0   229   100   100
PREHEAT HOODS
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2401     3.58   1.72    1.72    1.72 5923804473606   10.0    229    100    100
160" REHEAT FURNACE
241     26.80  12.80   12.80   12.80 5919754473450   70.0    227    477   25.9 1.52
160" IN-OUT FURNACE
242      7.26   3.48    3.48    3.48 5919584473250   31.0    227    477    7.0  .68
243      3.58   1.73    1.73    1.73 5919504473450   31.0    227    477    3.4  .68
#2 FORGE
244      4.07   1.92    1.92    1.92 5927334473833   30.0    229    477    6.8  .91
245      2.04    .98     .98     .98 5927334473833   30.0    229    477    3.4  .38
246      1.75   0.82    0.82    0.82 5927334473833   24.0    229    477    2.8  .38
247      3.29   1.56    1.56    1.56 5927334473833   24.0    229    477    5.5  .91
248      5.71   2.74    2.74    2.74 5927334473833   24.0    229    477    9.5  .99
249      1.94   1.91    1.91    1.91 5927334473833   18.0    229    477    1.5  .38
250      6.00   2.90    2.90    2.90 5927334473833   29.0    229    477   10.1  .99
HARVEY FORGE
251      1.34   0.65    0.65    0.65 5932254473893   24.0    229    477    1.0  .68
252      2.13   1.04    1.04    1.04 5932254473893   25.0    229    477    1.7  .68
253      2.13   1.04    1.04    1.04 5932254473893   24.0    229    477    1.7  .68
254      1.84   0.88    0.88    0.88 5932254473893   24.0    229    477    1.4  .68
48" MILL
255      2.50   1.16    1.16    1.16 5938654473555   32.0    229    477    3.4  .68
BOILER
256     19.26   9.91    9.91    9.91 5942924474640   44.7    222    588  270.4 1.75
BOILER
257     19.26   9.91    9.91    9.91 5942834474750   44.7    222    588  167.9 1.25

USS EDGAR THOMSON
SOAKING PITS
258     45.72  14.96   14.96   14.96 5974404471870   30.0    233    533   42.1  .88
BOILERS
259      7.06   2.29    2.29    2.29 5970834471740   50.0    221    616   69.6 1.91
BOILERS
260      7.06   2.29    2.29    2.29 5972604471685   50.0    221    616   69.6 1.91
BOILERS
261      7.06   2.29    2.29    2.29 5972764471673   50.0    221    616   69.6 1.91
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J&L PITTSBURGH
KEELER BOILER
262     32.20   32.20   32.20   32.20 5892604473890  24.4   235   405   9.3   .66
RILEY BOILER
263     30.90   30.90   30.90   30.90 5892604473890  21.7   235   566  13.2   .98
SOUTHSIDE BOILERS
264     55.50   55.50   55.50   55.50 5880004475340  36.0   225   461  38.7  1.22
265     24.80   24.80   24.80   24.80 5885004475490  41.5   219   505 15.60  1.34
10" MILL
266     12.20   12.20   12.20   12.20 5892804474080  38.1   238  1089  25.5  1.06
14" MILL
267      6.00    6.00    6.00    6.00 5893004474120  38.1   238  1089   8.9   .84
COKE BATTERIES
268     65.30   65.30   65.30   65.30 5891304474010  61.0   235   634  54.7  1.30
269     56.90   56.90   56.90   56.90 5891604473900  61.0   235   634  54.7  1.30
270     22.90   22.90   22.90   22.90 5892604473760  69.0   235   533  50.9  1.45
SOAKING PITS
279      2.40    2.40    2.40    2.40 5875504475520  50.0   236   810 104.4  0.76
280      0.50    0.50    0.50    0.50 5878304475520  35.0   236   810 104.2  0.77
281     22.90   22.90   22.90   22.90 5877804475520  46.0   226   811  18.7   .95
282      3.30    3.30    3.30    3.30 5877804475520  46.0   226   700   7.0   .95

USS HOMESTEAD
PACKAGE BOILERS
283      1.50    1.00    1.00    1.00 5925754473900  15.0   226   561 25.47  1.60

USS EDGAR THOMSON
B&W BOILERS
284      4.76    1.55    1.55    1.55 5972724471676  33.0   221   551 26.19  1.20

J&L PITTSBURGH
SLAB HEAT FURNACE
285      0.00    0.00    0.00    0.00 5883004475790  22.7   235   839 22.34  1.30
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J&L PITTSBURGH
TAIL GAS
286      0.00     0.00     0.00     0.00 5891804474100  30.5   235   350  5.31   .17
287       .90      .60      .60      .60 5985504469010  49.0   229   560 72.30  1.15
288       .90      .60      .60      .60 5985704469010  49.0   229   560 72.30  1.15
289       .90      .60      .60      .60 5985504469020  49.0   229   560 72.30  1.15
290       .90      .60      .60      .60 5985604469020  49.0   229   560 72.30  1.15
291       .90      .60      .60      .60 5985404469030  49.0   229   560 72.30  1.15
292       .90      .60      .60      .60 5985604469030  49.0   229   560 72.30  1.15
293      1.40      .90      .90      .90 5985504469040  49.0   229   476 57.30  1.15
294      1.40      .90      .90      .90 5985604469040  49.0   229   476 57.30  1.15
295      1.40      .90      .90      .90 5985404469050  49.0   229   476 57.30  1.15
296      1.40      .90      .90      .90 5985404469060  49.0   229   476 57.30  1.15
301      4.40     4.40     4.40     4.40 5880604475150  43.6   222   532 32.90   .92
302      4.40     4.40     4.40     4.40 5880604475150  43.6   222   532 32.90   .92
303      4.40     4.40     4.40     4.40 5880904475120  43.6   222   532 32.90   .92
304      4.40     4.40     4.40     4.40 5880904475120  43.6   222   532 32.90   .92
305      4.40     4.40     4.40     4.40 5881604475160  43.6   222   532 32.90   .92
306      4.40     4.40     4.40     4.40 5881604475160  43.6   222   532 32.90   .92
307      4.40     4.40     4.40     4.40 5882004475020  43.6   222   532 32.90   .92
308      4.40     4.40     4.40     4.40 5882004475020  43.6   222   532 32.90   .92
309      1.50     1.00     1.00     1.00 5925604473940  14.8   222   476 58.08  1.41

MONONGAHELA VALLEY SOURCES


ARMCO STEEL
DUQUESNE LIGHT ELRAMA          (DER HARRISBURG 6/8/79)
420  1428.861428.861428.861428.86 5920004456200 119.0   229   430195.60  3.96
WEST PENN POWER MITCHELL       (DER HARRISBURG 6/7/79)
426     30.00    30.00    30.00    30.00 5873404452810  59.0   232   464113.30  2.13
429     30.60    30.60    30.60    30.60 5873404452810  59.0   232   464113.30  2.13
430     25.20    25.20    25.20    25.20 5873404452810  59.0   232   422113.30  2.19
431  1175.251175.251175.251175.25 5873404452810 107.0   232   333519.20  3.05
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WHEELING-PITTSBURGH STEEL MONESSEN
432      5.70   5.70   5.70   5.70 5939144446100  31.0   230   505  2.00  .61
435     31.99  31.99  31.99  31.99 5939144446100  38.0   230   666  7.00  .91
440     16.83  16.83  16.83  16.83 5946224446236  57.0   230   334 83.10 1.22
441     67.40  67.40  67.40  67.40 5948124446177  56.0   230   405232.00 1.98
443     48.33  48.33  48.33  48.33 5944314446327  34.0   230   450 19.50 1.98
WHEELING-PITTSBURGH STEEL ALLENPORT
450      5.50   5.50   5.50   5.50 5987524437902  15.0   235   421  9.30 0.22
451     18.13  18.13  18.13  18.13 5987524437902  61.0   235   575 64.90 1.52
CALIFORNIA STATE TEACHERS COLLEGE
454      4.83   4.83   4.83   4.83 5952314435359  46.0   238   450  7.70 1.22
ALLIED CHEMICAL
460      5.49   5.49   5.49   5.49 5946444436862   8.0   234   355 18.90  .50
CORNING GLASS CHARLEROI
463      1.87   1.87   1.87   1.87 5936544444158  15.0   233   477  1.76  .46
470       .50                      5973514449231  15.0   232   533 11.16  .46


BEAVER VALLEY SOURCES


 J&L #5 BH - #58 BOILER
5001    10.10   8.20   8.20   8.20 5643304497350  46.6   219   533 75.28 1.30
 J&L #6 BOILER HOUSE
5002   129.39  89.64  89.64  89.64 5643104497560  76.2   232   485202.28 2.09
 J&L NEW #6 BOILER HOUSE
5003   357.93  23.44  23.44  23.44 5641604494236  83.3   232   498513.82 3.05
 J&L A-1N. ST.
5004    34.12   1.81   1.81   1.81 5645904497990  68.6   232   577 42.71 1.45
 J&L A-1S. ST.
5005    34.12   1.81   1.81   1.81 5646004497940  68.6   232   577 42.71 1.45
 J&L A-5 ST.
5006    74.22   4.16   4.16   4.16 5645904497790  76.2   232   577 19.66 1.68
 J&L A-5N. PREHEAT
5007     6.98   0.55   0.55   0.55 5645904497790  64.3   232   358 12.72  .56
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 J&L A-5S. PREHEAT
5008      6.98   0.55    0.55    0.55 5645904497790  64.3    232    358 12.72  .56
 J&L OTHER SOURCES
5109     37.25                        5644874497661  76.0    228    602 25.40 1.68
5110     68.24                        5644884497568  76.0    227    600 19.73 1.45
5111     15.51                        5643744497197  38.0    226    700 34.30 1.22
5112     35.64                        5643464497721  53.3    229    589 52.90  .76
5113     16.14                        5642944495593  38.0    216    977  8.70 1.07
5114      1.01                        5642944495531  30.0    216    977  6.10  .30
5115      1.64                        5643414495532  27.0    216    977 10.40  .76
5116     15.94                        5642254495407  38.0    218    977 13.80  .91
5117     31.87                        5642264495346  38.0    218    977 13.80  .91
5118     32.31                        5642084494605  38.0    218    977 21.30  .91
5119     14.81                        5643464497752  53.3    229    977 12.50  .91
5120     56.87                        5640644497749  31.0    232    311 17.80  .46
5121     16.14                        5643724497382  61.0    226    533 38.50 1.37
5122     13.84                        5643724497382  61.0    226    533 38.50 1.37
5123      8.95                        5641514495777  27.0    219    811  4.00  .76
5124      8.34                        5642464495716  27.0    218    422  2.10  .76
5125     10.24                        5642464495716  27.0    218    700  6.90  .76
5126     27.70                        5642464495654  38.1    218    977 14.00  .87
 CRUCIBLE STEEL - MIDLAND
5301     66.51                        5459484498109  31.6    235    533 43.20 1.00
5302      1.83                        5457984497800   7.3    233    533 10.42  .46
5303     23.09                        5459524497523  27.2    232    533 25.24  .76
5304     15.51                        5460234497431  30.6    232    533  3.38  .76
5305      3.88                        5460474497308  18.3    226    533  8.11  .76
5306      7.76                        5461004497300  11.9    226    533  9.03  .46
5307     32.56                        5461504497250  76.0    226    477 90.30 1.83
 MEDUSA CEMENT
5380    103.77 152.70  152.70  152.70 5568744525270    91    244    589113.30 1.83
5381      4.41   6.07    6.07    6.07 5568744525270    40    244    560153.00 1.68
 ARCO #1 BOILER
5384     20.50  60.53   60.53   60.53 5546304500620    61    229    330 59.70  .91
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 ARCO #2 BOILER
5385   128.86 165.58 165.58 165.58 5546304500620    61    229    330 59.70   .91
 ARCO #3 BOILER
5386   116.20 167.57 167.57 167.57 5546304500620    61    229    330 59.70   .91
 ARCO OIL BOILER
5387   120.29                      5546304500620    61    229    330 59.70   .91
5388     2.50   0.89   0.89   0.89 5546304500620    55    229    399 22.66  1.98
 B&W WALLACE RUN
5391     7.07  10.47  10.47  10.47 5552644515255    21    275    575 11.67  0.76
 B&W AMBRIDGE BOILERS #1,#2
5395     9.66   9.66   9.66   9.66 5652834495355    26    233    450 23.40  1.14
 B&W TUBULAR PRODUCTS
5398     5.66   5.66   5.66   5.66 5564984513322    23    268    536 32.42  0.76
5399     1.50   1.50   1.50   1.50 5564984513322    21    268    577 16.06  0.91
 SHENANGO CHINA (INTERPACE CORP.)
5402     1.80   5.12   5.12   5.12 5537014539975    41    245    471  7.36  0.76
 ASHLAND OIL CRUDE HEATER
5404     0.70   0.70   0.70   0.70 5623154504580    34    229    477  6.45   .53
 ASHLAND OIL CHARGE HEATER
5405     1.24   1.24   1.24   1.24 5623154504580    18    229    477  4.15   .26
 ASHLAND OIL BOILERS #1-3
5406     1.86   1.86   1.86   1.86 5623154504580    58    229    422 30.50  1.22
 ASHLAND OIL VACUUM HEATER
5407     0.48   0.48   0.48   0.48 5623154504580    34    229    477  2.28   .53
 ASHLAND OIL NRV, RERUN & BRIGHT ST. HEATERS
5408     0.97   0.97   0.97   0.97 5623154504580    18    229    477  2.90   .26
 WESTINGHOUSE ELECTRIC BEAVER
5413     1.78   1.78   1.78   1.78 5575284486194    15    243    515 24.69  0.71
 HERCULES INC.
5469     0.50   0.50   0.50   0.50 5973514449231    15    232    533 11.16  0.46
 WEST PENN POWER WEST PITTSBURGH
   UNIT #031,#032
5472  1029.50 199.15 199.15 199.15 5531054531767   229    238    413663.37  4.00
 PENN POWER MANSFIELD
5479   235.89 235.89 235.89 235.89 5490494498067   290    219    341740.36  2.90
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 ST JOE MINERALS 275' STACK
5512   398.20 241.24 241.24 241.24 5552234501841    84    236    422 80.20 1.68
 ST JOE MINERALS 200' STACK
5513 0 130.64 118.89 118.89 118.89 5561604502218    61    236    347122.3  1.52
 ST JOE MINERALS 400' STACK
5514 0 164.40 157.50 157.50 157.50 5560654502301   122    236    336 213.7 2.44
 BESSEMER CEMENT UNIT #2
5518 0  25.50  52.93  52.93  52.93 5428604535850    67    320    477 51.4  1.68
 BESSEMER CEMENT UNIT #3
5519 0  33.00  59.89  59.89  59.89 5428604535850    67    320    505 91.6  1.98


 OTHER PENNSYLVANIA SOURCES


 ARMSTRONG POWER STATION
6021    538.12 538.12 538.12 538.12 6289794531996  70.0    258    405 160.0 2.30
6022    600.00 600.00 600.00 600.00 6289794531996  70.0    258    439 285.0 2.30
 CARPENTERTOWN COAL
6031     37.16  37.16  37.16  37.16 6329974530988   5.0    274   .9921177.4  .10
 KEYSTONE POWER STATION
6041  3710.963710.963710.963710.96 6401414502155 244.0    311    4081193.8 4.60
 HOMER CITY POWER STATION
6051  3020.553020.553020.553020.55 6527564486147 244.0    366    405 874.8 4.70
 CONEMAUGH POWER STATION
6061  4343.844343.844343.844343.84 6645824471929 305.0    330    4081194.0 4.10
 SEWARD POWER STATION
6071    627.50 627.50 627.50 627.50 6668824474602  69.0    332    4142070.0 1.50
6072    763.50 763.50 763.50 763.50 6668824474602  69.0    332    450 126.7 1.20
 HATFIELD POWER STATION
6081  8503.508503.508503.508503.50 5915704412040 289      220    340 740.3 2.89
 ALVERTON FUEL
6091      3.20   3.20   3.20   3.20 6192894443933   5.0    334    922 221.3  .10
6092      6.90   6.90   6.90   6.90 6205444443891   5.0    334    922  88.5  .10
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SLIPPERYROCK COLLLEGE
6101    31.20  31.20  31.20  31.20 5798254545763  53.0   412   505  25.6  .90
 SUNNEBORN
6111    58.30  58.30  58.30  58.30 6077764540569  61.0   366   505  15.8 1.25
 SHENLEY DISTILLERS
6121    27.10  27.10  27.10  27.10 6134204505200  24.0   251   477   7.4  .80


 EASTERN OHIO SOURCES
                  NOTE: 1975 EMISSIONS DATA WERE USED FOR NON-POWER
                        STATION SOURCES DUE TO A LACK OF COMPLIANCE
                        DATA. 1975 EMISSIONS DATA WAS ALSO USED FOR
                        THE EAST PALESTINE POWER STATION.
                        THE COMPLIANCE DATA FOR THE OHIO POWER
                        STATIONS WAS OBTAINED FROM EPA REGION III.

                     **  UPDATED 06 JULY 1979 **
                         HENRY MODETY REGION V

 FEDERAL PAPERBOARD
8003   153.00 153.00 153.00 153.00 5332004468900    71   256   644 45.95 1.50
 KAOL CLAY
8011     5.90   5.90   5.90   5.90 5330004481300    46   283   421  1.41 1.51
 OHIO EDISON TORONTO
8023   827.40 827.40 827.40 827.40 5335004481800   198   201   441368.40 2.29
 OHIO EDISON SAMMIS
8031  1210.401210.401210.401210.40 5317004485500   154   210   405598.03 3.20
8032  1210.401210.401210.401210.40 5317004485500   154   210   405619.21 3.05
8035  3027.903027.903027.903027.90 5317004485500   259   210   405507.11 4.76
8036  2988.602988.602988.602988.60 5317004485500   305   210   4051050.9 4.09
 OHIO EDISON BURGER
8041  2358.402358.402358.402358.40 5205004417500   259   198   4661088.0 3.30
 OHIO EDISON TIDD
8051   156.60 156.60 156.60   0.00 5299004455700    75   207   455 99.10 1.50
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8052   156.60 156.60 156.60   0.00 5299004455700    75    207    455 99.10 1.50
8053   392.00 392.00 392.00   0.00 5299004455700    75    207    455234.91 2.15
 CARDINAL POWER STATION
8061  1321.101321.101321.101321.10 5300004455800   252    198    447897.84 3.36
8062  1321.101321.101321.101321.10 5300004455800   252    198    447897.84 3.36
8063   764.80 764.80 764.80 764.80 5300004455800   274    204    4301025.5 3.66
 TORONTO PAPERBOARD
8071     8.50   8.50   8.50   8.50 5337004480200    20    215    394 15.23 1.05
 NATIONAL STEEL WEIRTON DIVISION
8081    14.80  14.80  14.80  14.80 5327004467000    51    204    516 11.12  .85
8082    14.80  14.80  14.80  14.80 5327004467000    51    204    516 11.12  .85
8083    14.80  14.80  14.80  14.80 5327004467000    51    204    516 11.12  .85
8084    14.80  14.80  14.80  14.80 5327004467000    51    204    516 11.12  .85
 WHEELING-PITTSBURGH STEEL NORTH PLANT
8091   138.50 138.50 138.50 138.50 5325004466700    84    204    589 44.49 1.70
8092    80.70  80.70  80.70  80.70 5325004466700    39    204    505 26.24 1.20
8093    80.70  80.70  80.70  80.70 5325004466700    39    204    505 26.24 1.20
8094    80.70  80.70  80.70  80.70 5325004466700    39    204    505 26.24 1.20
8095    35.30  35.30  35.30  35.30 5325004466700    50    204    533 27.04  .75
8096    35.30  35.30  35.30  35.30 5325004466700    50    204    644  3.12 1.05
8097    35.30  35.30  35.30  35.30 5325004466700    50    204    644  6.23 1.05
8098    35.30  35.30  35.30  35.30 5325004466700    50    204    644  6.23 1.05
8099    35.30  35.30  35.30  35.30 5325004466700    50    204    644  3.71  .75
 WHEELING-PITTSBURGH STEEL SOUTH PLANT
8121    94.40  94.40  94.40  94.40 5346004463300    91    204    589 58.99 2.35
8122    37.00  37.00  37.00  37.00 5346004463300    49    204    519 12.57 1.00
8123    36.60  36.60  36.60  36.60 5346004463300    49    204    519 12.57 1.00
8124    34.30  34.30  34.30  34.30 5346004463300    49    204    519 12.57 1.00
8125    34.30  34.30  34.30  34.30 5346004463300    49    204    519 12.57 1.00
8126    34.30  34.30  34.30  34.30 5346004463300    49    204    519 12.57 1.00
8127    34.30  34.30  34.30  34.30 5346004463300    49    204    519 12.57 1.00
8128    49.80  49.80  49.80  49.80 5346004463300    49    204    519 12.57 1.00
8129    49.80  49.80  49.80  49.80 5346004463300    49    204    547 13.51 1.00
8130    18.80  18.80  18.80  18.80 5346004463300    33    204    644  3.82  .90
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8131     18.80  18.80  18.80  18.80 5346004463300    33    204    644  3.82  .90
8132     18.80  18.80  18.80  18.80 5346004463300    50    204    700  3.82  .90
8133     18.80  18.80  18.80  18.80 5346004463300    50    204    700  3.82  .90
8134     18.80  18.80  18.80  18.80 5346004463300    50    204    700  3.82  .90
 WHEELING-PITTSBURGH STEEL YORKVILLE
8141    102.80 102.80 102.80 102.80 5254004445400    63    205    422  6.01 1.80
8142    128.50 128.50 128.50 128.50 5254004445400    63    205    422  6.01 1.80
 WHEELING-PITTSBURGH STEEL MARTINS FERRY
8151     47.40  47.40  47.40  47.40 5247004439200    24    202    510  1.13  .60
8152    142.50 142.50 142.50 142.50 5247004439200    38    202    516  7.07 1.50
 OHIO EDISON EAST PALESTINE
8161     18.70  18.70  18.70  18.70 5359004520300    30    314    561 38.17 1.50
8162     12.60  12.60  12.60  12.60 5359004520300    29    314    561 26.15  .75
8163      9.20   9.20   9.20   9.20 5359004520300    58    314    561 26.15  .75
 CONALCO
8171      3.90   3.90   3.90   3.90 5150004396500    18    195    589  5.08  .60
8172     47.60  47.60  47.60  47.60 5150004396500    18    195    297  7.85  .70
8173      1.50   1.50   1.50   1.50 5150004396500    21    195    589 15.81  .44
8174      0.80   0.80   0.80   0.80 5150004396500     6    195    589  8.30  .75


 WEST VIRGINIA SOURCES
                     NOTE: WEST VIRGINIA EMISSIONS DATA WERE
                           OBTAINED FROM THE DATA PROVIDED BY
                           WEST VIRGINIA AND REGION X:  1978A


 ALLIED CHEMICAL
9001     94.00  94.00  94.00  94.00 5167004417000    31    203    299  6.20 1.00
9002    160.00 160.00 160.00 160.00 5167004417000    31    203    293  6.50 1.30
9003      0.00   0.00   0.00   0.00 5167004417000    20    203    800 15.00 1.00
 BANNER FIBREBOARD
9011     16.70  16.70  16.70  16.70 5333004458800     7    204    575 11.70  .50
 BLAW-KNOX PENINSULA PLANT
9021      1.90   1.90   1.90   1.90 5239004436400    40    201    755  9.49  .58
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 CITY SERVICE
9042     1.20    1.20    1.20    1.20 5115004398700    23    204    507 19.20   .46
9043     1.20    1.20    1.20    1.20 5115004398700    23    204    507 12.60   .57
9044     1.50    1.50    1.50    1.50 5115004398700    24    204    507 14.90   .61
9045     1.50    1.50    1.50    1.50 5115004398700    24    204    507 14.90   .61
 DIECKMANN & SONS
9050     8.50    8.50    8.50    8.50 5308004434000    25    209    633 11.20   .60
 GLOBE REFRACTORY
9061    35.00   35.00   35.00   35.00 5319004495700    12    207    533 21.40   .73
9062    35.00   35.00   35.00   35.00 5319004495700    12    207    533 21.40   .73
9063     5.40    5.40    5.40    5.40 5319004495700    11    207    583  7.15   .73
9064     7.60    7.60    7.60    7.60 5319004495700     6    207    516  3.46   .43
 H. B. REED
9071     0.10    0.10    0.10    0.10 5159004407400    12    204    327  6.68   .42
 KAMMER POWER STATION
9081  2458.002458.002458.002458.00 5153204410320   183    197    442613.10 2.38
9082  1229.001229.001229.001229.00 5153304410330   183    197    442305.90 1.68
 KOPPERS
9091    25.00   25.00   25.00   25.00 5334004465500    61    204    589 30.90 1.55
9092    15.00   15.00   15.00   15.00 5334004465500    44    204    589 18.40 1.07
9093    23.00   23.00   23.00   23.00 5334004465500    58    204    477 25.20   .68
9095    35.20   35.20   35.20   35.20 5334004465000    15    204    789  2.58   .38
9096     0.20    0.20    0.20    0.20 5334004465000    21    204   1144  1.60   .08
9097     0.00    0.00    0.00    0.00 5334004465000    61    204    477 35.7   1.55
9098    12.30   12.30   12.30   12.30 5334004465000    38    204    755 12.3   1.55
 MITCHELL POWER STATION
9101  6295.246295.246295.246295.24 5158004408670   366    210    4412410.0 5.03
 MOBAY CHEMICALS
9111   135.20  135.20  135.20  135.20 5147004397200    15    199    452 14.28   .88
 OHIO VALLEY MEDICAL CENTER
9131     8.20    8.20    8.20    8.20 5238004434300    38    219    633  4.75 1.10
 PPG INDUSTRIES
9141   295.00  295.00  295.00  295.00 5126004399600    69    200    450 79.70 2.45
9142   275.00  275.00  275.00  275.00 5126004399600    91    200    436123.60 1.35
9143    45.00   45.00   45.00   45.00 5127004399800    31    207    477  2.36   .38
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 QUAKER STATE REFINERY
9151     26.00  26.00  26.00   26.00 5309004496200     46    207    561 37.70   .91
9152     26.00  26.00  26.00   26.00 5309004496200     46    207    561 37.70   .91
9153     26.00  26.00  26.00   26.00 5309004496200     46    207    561 37.70   .91
9154     10.00  10.00  10.00   10.00 5309004496200     38    207    522  7.10   .46
9155      5.30   5.30   5.30    5.30 5309004496200     38    207    533 10.20   .84
9156      3.30   3.30   3.30    3.30 5309004496200     38    207    700  7.90   .91
9157     10.00  10.00  10.00   10.00 5309004496200     67    207    866   .05   .70
 S. GEORGE
9161      3.80   3.80   3.80    3.80 5329004458200     24    204    633   .50   .53
 TAYLOR, SMITH & TAYLOR
9181      6.50   6.50   6.50    6.50 5373004496300     38    207    477  4.67   .57
 TRIANGLE CABLE & CONDUIT
9191     21.50  21.50  21.50   21.50 5209004420300     24    207    586  8.80   .57
 U. S. STAMPING
9201      5.60   5.60   5.60    5.60 5225004419400     24    209    421  1.32   .54
 VALLEY CAMP COAL #1
9211      5.50   5.50   5.50    5.50 5308004444800     23    255    394 54.10  2.55
9212      5.50   5.50   5.50    5.50 5308004444800     26    255    394 45.20  1.10
 VALLEY CAMP COAL #3
9221      2.80   2.80   2.80    2.80 5333004434600     24    248    394 15.10   .91
9222      1.70   1.70   1.70    1.70 5333004434600     26    248    394  9.10   .91
 NATIONAL STEEL BROWNS ISLAND COKE
9231    134.00 134.00 134.00  134.00 5333004474800     76    232    533 53.60  2.06
9232      2.00   2.00   2.00    2.00 5333004474800     42    232    866 19.20   .38
92331     0.30   0.30   0.30    0.30 5333004474800     25    232    100   100
 NATIONAL STEEL MAINLAND COKE
9252      7.25   7.25   7.25    7.25 5338004474600     76    232    555 19.20  1.37
9253      7.25   7.25   7.25    7.25 5338004474600     76    232    555 19.20  1.37
9254      8.45   8.45   8.45    8.45 5338004474600     76    232    555 22.40  1.68
9255     11.28  11.28  11.28   11.28 5338004474600     76    232    555 14.94  1.30
92571     3.80   3.80   3.80    3.80 5338004474600     18    232    100   100
 NATIONAL STEEL SINTER PLANT
9262     89.00  89.00  89.00   89.00 5343004474100     49    232    422257.00  2.29
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 WHEELING HOSPITAL
9271      1.50    1.50    1.50    1.50 5234004436800    35   207   633  2.16   .91
 WHEELING-PITTSBURGH STEEL BENWOOD PLANT
9281     15.40   15.40   15.40   15.40 5229004430200    21   198   450 10.00   .66
9285     15.00   15.00   15.00   15.00 5335004465600    26   204   335  3.30   .30
9286     13.00   13.00   13.00   13.00 5335004465600    76   204   422 43.10  1.98
9287      0.00    0.00    0.00    0.00 5335004465900    17   204   426 14.20   .60
 WHEELING-PITTSBURGH STEEL COKE PLANT
9291     20.00   20.00   20.00   20.00 5335004465900    61   204   616 19.90  1.26
9292     20.00   20.00   20.00   20.00 5335004465800    61   204   616 19.90  1.26
9293     23.00   23.00   23.00   23.00 5335004465700    69   204   616 22.40  1.22
92971     6.40    6.40    6.40    6.40 5335004465600    18   204   100   100
9298     34.00   34.00   34.00   34.00 5335004465600    76   204   616 32.20  1.35
9299     33.00   33.00   33.00   33.00 5335004465600    76   204   616 32.20  1.35
9300     39.00   39.00   39.00   39.00 5335004465600    76   204   616 37.80  1.35
 WHEELING-PITTSBURGH STEEL SINTER PLANT
9301     19.00   19.00   19.00   19.00 5335004465200    30   204   325 81.80  1.22
 NATIONAL STEEL WEIRTON DIVISION
9341    540.00  540.00  540.00  540.00 5343004474400    43   204   505118.20  1.52
9344    250.00  250.00  250.00  250.00 5343004474400    43   204   505118.00  1.52
9345    106.00  106.00  106.00  106.00 5343004474400    55   204   505 91.40  1.68
9346     70.00   70.00   70.00   70.00 5343004474400    67   204   505 76.00  2.30
9351     16.00   16.00   16.00   16.00 5343004474400    67   204   530 96.00  2.30
9352     22.00   22.00   22.00   22.00 5348004473800    61   204   333118.00  2.70
9353      5.40    5.40    5.40    5.40 5350004473000    46   204   540  4.20  1.06
9354    224.20  224.20  224.20  224.20 5350004473000    61   204   520 41.60  1.45
9355      4.90    4.90    4.90    4.90 5350004472900    40   204   650  5.00   .86
9356      3.00    3.00    3.00    3.00 5350004472900    26   204   650  2.37   .44
9357      2.06    2.06    2.06    2.06 5350004473000    29   204   480   .56   .69
9358      4.20    4.20    4.20    4.20 5350004473000    15   204   480   .22   .17
9359     13.41   13.41   13.41   13.41 5350004473000    30   204   420  1.10  1.07
9360     35.00   35.00   35.00   35.00 5350004473000    53   204   505  4.78   .95
9361      0.00    0.00    0.00    0.00 5351004472500    24   232   366  4.20   .30
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APPENDIX C.4

The following changes to the emissions inventory were received from the Commonwealth of Pennsylvania Department of Environmental Resources and the West Virginia Air Pollution Control Commission after review of the Draft Final Report. These changes are included here for reference and no attempt has been made to assess the effects of these changes on the study results. We point out that the changes received from the West Virginia Air Pollution Control Commission refer only to changes in SO_2 emission rates and do not include other changes that may have occurred in stack exit temperatures and flow rates. Without this information, it is not possible to estimate the effects of the changes in emission rates on the calculated concentrations.

CORRECTIONS AND CHANGES RECEIVED FROM THE WEST VIRGINIA AIR POLLUTION CONTROL COMMISSION

	Emissions (g/sec)	
Source	Cramer Report	Recent WVAPCC Inventory*
Allied Chemical		
#1-4, Coal Fired Boilers (9001,9002)	84.0	48.0
North Plant Boilers (9003)	12.9	12.2
Banner Fiberboard		
Two Oil-Fired Boilers (9011)	14.0	14.0
Blaw-Knox Penindula Plant		
#3 Open Hearth (9021)	2.1	0
City Service (now is Columbian Carbon)		
#1 Reactor (9042)	1.2	1.2
#2 Reactor (9043)	1.2	1.2
#3 Reactor (9044)	1.5	1.5
#4 Reactor (9045)	1.5	1.5
Dieckmann & Sons		
Three Coal-Fired Boilers (9050)	8.5	8.5
Globe Refactory		
#5A, #4 Tunnel Kiln (9061, 9063)	50.0	22.0
#5B, #2 Tunnel Kiln (9062, 9064)	46.4	22.0
HB Reed		
(9071)	.1	.1
Kammer Power		
(9081)	2770.0	2770.0
(9082)	1385.0	1385.0
Koppers		
#2 Coal/Oil-Fired Boiler (9091)	8.0	8.0
#3 Coal/Oil-Fired Boiler (9092)	13.0	13.0
#4 Coal-Fired Boiler (9093)	28.0	28.0
F2 Flare (9095)	39.0	0.5
H2S Flare (9096)	0.5	0.5
#5 Coal-Fired Boiler (9097)	50.0	50.0
Mitchell Power		
(9101)	9289.0	9289.0
Mobay Chemicals		
#9, #10 Oil-Fired Boilers (9111)	85.0	35.0

Source	Emissions (g/sec)	
	Cramer Report	Recent WVAPCC Inventory
Ohio Valley Medical Center		
Three Coal/Oil-Fired Boilers (9131)	4.6	4.6
PPG		
#4 Coal-Fired Boiler (9141)	175.0	175.0
#5 Coal-Fired Boiler (9142)	308.0	308.0
Sulfur Recovery (9143)	45.0	45.0
Quaker State Refinery		
#1 Oil-Fired Boiler (9151)	57.0	23.3
#2 Oil-Fired Boiler (9152)	57.0	23.3
#3 Oil-Fired Boiler (9153)	57.0	23.3
H-101 Crude Heater (9154)	12.0	12.0
Plateformer (9155)	6.0	6.0
150 Heater (9156)	4.0	4.0
Waste Gas Flare (9157)	12.0	12.0
St. George (Shutdown)		
Two Coal-Fired Boilers (9161)	3.8	0.0
Taylor Smith & Taylor (now is Anchor Hocking)		
Two Coal-Fired Boilers (9181)	7.2	7.2
Triangle Conduit (now is Triangle PWC)		
Three Coal-Fired Boilers (9191)	21.5	21.5
US Stamping (Shutdown)		
Two Coal-Fired Boilers (9201)	5.6	0.0
Valley Camp Coal #1		
#2 Thermal Dryer (9211)	5.5	5.5
#1 Thermal Dryer (9212)	5.5	5.5
Valley Camp Coal #3 (Shutdown)		
#1 Thermal Dryer (9221)	2.8	0.0
#2 Thermal Dryer (9222)	1.7	0.0
National Steel - Brown's Island Coke		
Battery Underfire (9231)	18.6	18.6
Gas Flare (9232)	2.0	2.0
Battery Area (92331)	0.3	0.3
Mainland Coke		
Battery #5 Underfire (9252) (Shutdown)	9.1	0
Battery #6 Underfire (9253) (Shutdown)	9.1	0
Battery #7 Underfire (9254)	10.6	0.4
Battery #8, #9 Underfire (9255) (Shutdown)	14.0	1.6
Battery Area (92571) (#7 & 8 only)	3.8	1.6

Source	Emissions (g/sec)	
	Cramer Report	Recent WVAPCC Inventory
National Steel - Sinter Plant		
#2 Wind Box (9262)	89.0	89.0
Wheeling Hospital		
Coal-Fired Boilers (9271)	1.5	1.5
Wheeling - Pittsburgh Steel - Benwood		
#1, #2 Coal Boilers (9281) (now oil)	3.9	3.9
Wheeling-Pittsburgh Steel - Follansbee		
Desulfurization (9285)	15.0	15.0
#8 Battery Underfire (9286)	13.0	0.1
#4, #5 Boilers (9287)	7.0	7.0
#6-8 Boilers (9288) (only 6 & 7 coal)	79.0	46.2
#8 package (#2 oil)		1.8
#1 Battery Underfire (9291)	2.5	0.4
#2 Battery Underfire (9292)	2.5	0.4
#3 Battery Underfire (9293)	2.8	0.5
#1-3, #8 Area Sources (92971)	3.4	3.4
#1 Strand Wind Box (9301)	18.7	18.7
National Steel -Weirton Division		
#1-3 Coal-Fired Boilers (9341)	540.0	540.0
#4 Coal Fired Boiler (9344)	185.0	103.0
#5 COG-Fired Boiler (9345)	211.0	170.0
P1, P2 Gas Boilers (9346)	158.0	86.0
#15 COG Boiler (9351)	16.0	1.4
#6, #7 Heat Exchangers (9352)	22.0	22.0
60 T Reheat (9353)(Shutdown)	2.6	0.0
#1-4 Reheats (9354)	295.0	107.9
#1, #2 Spelters (9355)	2.3	2.3
#3, #4 Spelters (9356)	1.5	1.5
Annealing Furnace (9357)	0.2	0.2
#1-12 Annealing Furnaces (9358)	0.6	0.6
Tin Mill (9359)	1.5	1.5
Blooming Furnace (9360)	19.6	19.6
HCl Regenerator (9361)	4.2	4.2

*Revisions reflecting 1980 operating parameters and Regulation X allowable SO_2 emission limits as further explained in comments Section of the worksheets.

CORRECTIONS AND CHANGES RECEIVED FROM THE COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

Source	Source Number	Change
Westinghouse Electric	5413	UTMX = 557.4, UTMY = 4504.7
Bruce Mansfield Power	5479	Emission Rate 461.03 g/sec Temperature 323 ^{o}K Volume 1480.72 m^3 Radius 5.79 meters
	5480	Emission Rate 230.46 Temperature 323 ^{o}K Volume 740.36 m^3 Radius 4.10 meters